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THE  
FUNDAMENTAL PRINCIPLES  
OF THE  
POSITIVE PHILOSOPHY

BEING THE FIRST TWO CHAPTERS  
OF THE  
"*COURS DE PHILOSOPHIE POSITIVE*"

OF  
AUGUSTE COMTE

TRANSLATED BY  
PAUL DESCOURS AND H. GORDON JONES

WITH A BIOGRAPHICAL PREFACE BY  
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## PREFACE

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AUGUSTE COMTE was born at Montpellier on January 19th, 1798, five years after the execution of Louis XVI. His father was a revenue officer, of no great means. Both parents were Royalists and strict Catholics, and it is not known that they or any of his relations were distinguished by ability of any kind. He was educated at the *lycée* of his native town, where he showed extraordinary precocity and ardour for study, but a rebellious disposition in matters of discipline. When only fifteen he came out first in the entrance examination to the Polytechnic School, but on account of his youth was not actually admitted till the following year (1814). Here, under the best teachers in France, he studied the higher mathematics, physics, and chemistry with his usual ardour. In 1816 (the year after Waterloo) he took the lead in a demonstration against an unpopular official, and the Government, regarding the Polytechnic as a hot-bed of republicanism, gladly seized the opportunity of dismissing all the students. His prospects in the public service were thus destroyed, and at the age of eighteen he had to support himself by giving private lessons in mathematics, devoting all his spare time to the study of biology and history.

While still under twenty Comte came under the influence of the celebrated Saint-Simon, then his senior by forty years, who, though destitute of real philosophical capacity or scientific instruction, was gifted with a fertile imagination, and had caught a confused glimpse of some of the ideas that Comte was destined to think out and establish. This has led to a needless controversy as to the younger man's originality. To deal with it here is impossible. I am content to quote the judgment of Mr. John Morley, who is not a Comtist: "The most cursory glance into Saint-Simon's writings is enough to reveal the thread of connection between the ingenious visionary and the systematic thinker. We see the debt, and we also see that, when it is stated at the highest possible, nothing has really been taken from Comte's claims as a ~~successful~~ original thinker, or from his immeasurable pre-eminence over Saint-Simon in intellectual grasp and vigour and coherence." Saint-Simon saw that theology no longer supplied a sufficient basis for social order, still less for social progress, and that such a basis could only be obtained by applying to social phenomena the methods that had successfully created



the simpler sciences. But he and his followers had neither the scientific training nor the patience to perform this work. They preferred the easier course of starting fantastic plans of social reorganisation suggested only by their uninstructed imagination, and they tried to bring these into immediate practice by fervid and anarchical appeals to popular sentiment.

Comte looked on this as quackery, and, while equally bent on social regeneration, set himself to lay the intellectual foundation for it by creating the science of Sociology; a work that could not have been originally performed by anyone not versed in the principal doctrines of the simpler sciences, and in the methods by which they had been established. For this work Comte was qualified by the encyclopædic training which, while still a young man, his quick apprehension, his prodigious memory, and his ardour for study had enabled him to acquire.

His earliest publications were essays which appeared in various periodicals. Six of them, written between 1819 and 1828, contain the leading ideas which he subsequently co-ordinated and developed in his larger works. In one of them, the "Plan of the scientific works necessary for the Reorganisation of Society," published in 1822, will be found the first announcement of the two famous laws of the Three States and the Classification of the Sciences. These six essays Comte reprinted long afterwards as an appendix to the fourth volume of the *Positive Polity*, in order to prove, as they most

clearly do, that the regeneration of society had been his aim from the first, and that his "fundamental" treatise on Positive Philosophy had always been meant as preliminary to his "principal" treatise on Positive Polity.

In the spring of 1826 the outlines of the Philosophy were already so clearly mapped out in his mind that he could undertake to expound it orally in a course of seventy-two lectures, to be completed in twelve months; a prodigious effort, since the lectures did not exist on paper, and he always spoke without notes. It may here be mentioned that each volume of his most important works was completely composed in long meditations without putting pen to paper. When this mental composition of the volume was finished, he wrote it out without pause as if he was copying it. The lectures, begun in May, 1826, were attended by several eminent scientists. According to the programme, two were to be introductory; sixteen were allotted to mathematics; ten each to astronomy, physics, chemistry, and biology; and fourteen to social physics, or, as he afterwards called it, sociology. But after the third lecture the mental strain, aggravated by domestic and other quarrels, brought on an attack of insanity which lasted for some months. In January, 1829, he resumed the interrupted course, and carried it out successfully in exact accordance with the original programme.

<sup>1</sup> Comte coined the word "sociologie" in 1839. See *Phil. Pos.*, chap. xlvii.

These oral lectures were a first sketch of his famous "fundamental" work, the *Positive Philosophy*, of which the first volume appeared in 1830, the sixth and last in 1842. Soon afterwards he published his *Discourse on the Positive Spirit*, a little book intended to furnish those who are unable to read the larger work with its principal conceptions.<sup>1</sup>

The task which Comte had originally marked out for himself was divided into two undertakings—the one mental, the other social. In the first he set himself to co-ordinate the several abstract sciences into a philosophical system. This having been now accomplished, he had next to construct, upon the foundation so laid, a social and religious system; in other words, the theory of a State and a Church fitted to take the place of those that were no longer capable of securing order and progress in modern Europe. This was to be the subject of his *Positive Polity*. But before that work could be begun three changes, all of them important, though in different degree, took place in his life.

He had contracted an unfortunate marriage in 1825. His whole life since then had been made miserable by continual quarrels with his wife. In 1842 she left him, as she had several times done before. This time he refused to let her return. But to the end of his life he made her such a pecuniary allowance as his means permitted, and for some years he continued to correspond

with her. The separation was a profound relief to him, for their quarrels had, in his opinion, prolonged the time occupied in the composition of the *Positive Philosophy* by at least a third.

Comte's philosophy was very displeasing to both the theologists and the scientific specialists of his time. Their influence predominated in the Académie des Sciences, and prevented his obtaining a mathematical professorship in the Polytechnic School, for which he was admirably qualified. Always the most fiery of men, and incapable of yielding to any fear of consequences, Comte unwisely denounced his enemies in the preface to the last volume of his *Positive Philosophy*, and they very meanly retaliated by depriving him, in 1844 and 1852, of two mathematical posts in the Polytechnic which he had held for several years. The present fame and influence of Comte rest upon a much broader and deeper foundation than his services to any branch of natural science. But it is worth mentioning that candidates for the degree of *Licencié ès Sciences* are now expected to show a knowledge of the chapters on mathematics in the *Positive Philosophy*.

By these successive spoliations, and by the loss in 1848 of employment in a private school, he would have been reduced to destitution if friends had not come to his aid. In 1844-5 Mr. John Stuart Mill, who had read the *Positive Philosophy* with great admiration, induced Mr. Grote, Sir W. Molesworth, and Mr. Currie to make him two donations amounting together

<sup>1</sup> Translated, with explanatory notes by E. S. Beesly; cr. 8vo, 2s. net. (W. Reeves, 83, Charing Cross Road.)

to £240. In 1848 a subscription was got up for him, which was continued annually to the end of his life. This "sacerdotal subsidy," as he called it, produced at first £120, and latterly about £300. He was thus enabled to devote his time entirely to his philosophic work.

In October, 1844, Comte made the acquaintance of Madame Clotilde de Vaux. He was then forty-six; she was thirty. Her life had been blighted by marriage with a man who turned out badly, became a criminal, and had disappeared. She was at this time living with her parents. Like Comte, she had no child. There was, therefore, a certain similarity in their positions. Their more intimate friendship, which may be dated from April, 1845, was cut short only eleven months later by her death. On his part, there was the most ardent love; on hers, admiration and friendship, feelings which, as she told him from first to last, did not amount to love. Divorce not being then legalised in France, marriage was impossible, and he at first pressed her to become his mistress. To this she would not consent; their friendship remained a perfectly chaste one; and at length, as he came to feel the value of the discipline, he thanked her for having imposed it. Before he knew her his life, from the sexual point of view, had been faulty. Thenceforward it was one of strict continence.

The early death of Madame de Vaux only intensified his love and gratitude. He found his chief happiness in that daily communion with her to which he

gave the name of prayer. Every morning and evening a certain time was devoted to this sacred exercise, and every week he visited her tomb. All his subsequent work he regarded as inspired by her. That his love for her had a profound effect upon his moral nature is evident. It produced the inner change which, in the language of Christians, is called "conversion." Hitherto, though the ultimate object of his speculations had been to place morality on a firm basis of science, and though, in labouring for that end, he had been animated by a noble social spirit, he had not professed to be a religious teacher, or to set in his own person any special example of a good life. He was simply a philosopher working out a system which he believed would be of great benefit to the human race. But what he had before recognised as a philosophical truth—that love should be the moving principle of our lives—was now brought home to his heart. And this was fruitful of good.

It was in this period that he executed the second of his great works, his *Positive Polity*. His philosophical system was not the least altered, though his new experience coloured both thought and language. The four volumes were published between 1851 and 1854. Vol. IV.<sup>\*</sup> contains the proposals for social and religious reorganisation. They had already been partially set forth in two little treatises—the *General View of Positivism*,<sup>1</sup> published in 1848, and after-

<sup>\*</sup> Translated by J. H. Bridges, 2s. 6d. (W. Reeves, 83, Charing Cross Road.)

wards prefixed to Vol. I. of the *Polity*, and the *Catechism of Positive Religion*, which appeared in 1852.

Steadily executing the plan of work announced in 1842 at the end of the *Philosophy*, Comte next proceeded to write his *Subjective Synthesis*. The first and only volume appeared in 1856. On September 5th, 1857, he was overtaken by death at the age of fifty-nine.

Comte's tomb is in the cemetery of Père-Lachaise. Positivists from all parts of the world meet there on the anniversary of his death. His apartment, 10, Rue Monsieur-le-Prince, is piously preserved, just as he left it, by the Positivist Society of Paris, which he founded in 1848. Information about the London Positivist Society will be found in the *Positivist Review*, published monthly (3½d. post free) by W. Reeves, 83, Charing Cross Road.

A translation of Comte's *Philosophie Positive* will perhaps seem to many people unnecessary. It will be said that everyone, or almost everyone, who may desire to study that work will have sufficient acquaintance with the French language to be able to read it in the original. I suspect that this assumption is far from being well grounded. A knowledge of French which is more or less sufficient for enjoying a novel, a play, or a history may not carry the reader with sure step and unflagging attention through a

lengthy philosophical work; and, although Comte's style is forcible, occasionally even pungent and epigrammatic, it must be confessed that, for the most part, it is ponderous and fatiguing. Sometimes so compressed as to be obscure, more frequently redundant and verbose, often provokingly allusive, it makes demands upon the attention which discourage all but the most persevering readers.

These are faults which a translator who understands his business can, and should, do something to amend. If he contents himself with a literal rendering of every cumbrous, long-spun sentence, he is wasting his labour, for his version will be considerably less intelligible and attractive than the original. It is essential that he should not only be skilled in the art of turning the idioms of one language into those of another, but that he should have made a wide and careful study of Comte's other writings, so as to be competent to expand what is over-compressed, to condense what is verbose, and to substitute direct statements for indirect allusions. If this is done with judgment, the translation will be a boon to the English reader, even though he may be not unable to read the original.

The *Philosophie Positive* is known in England chiefly—it may be suspected, almost exclusively—through Miss Martineau's "Condensed Translation," in two volumes. When this first appeared in 1853, Comte praised it highly, going so far as to say: "My fundamental treatise will henceforth be best studied, at least by the majority of readers, in this unexampled translation, the reading

\* Translated by Richard Congreve, 2s. 6d. (Kegan Paul & Co.)

of the original being reserved for theoreticians properly so-called.”<sup>\*</sup> His examination of it, he says, had been “summary but sufficient.” If he had read it through, he would have found that it is not free from mistakes, and that the omissions, necessarily extensive, often detract from the force and completeness of the reasoning.

In 1852, writing to a young banker, Comte had suggested what seems to me a better mode of abridging the six volumes of the *Philosophie Positive* than that adopted by Miss Martineau. “I am very glad that you are so zealously studying my *Philosophie Positive*. But I would suggest a quicker and less laborious process as regards the first three volumes of this fundamental treatise. It is only theoreticians who will need to read the whole of it without omitting anything. Practicians, after reading the two introductory chapters, had better confine themselves to the general chapter which begins each of the five preliminary sciences—Mathematics, Astronomy, Physics, Chemistry, Biology. That is enough, and even better, for the purpose which you very sensibly describe to me. Nevertheless, looking at the logical importance of Mathematics, I advise you to read, besides the chapter

dealing with that subject as a *grand* whole, the three treating of Calculation, Geometry, and Mechanics as subordinate wholes. You have thus to read in the first volume six chapters, including the introduction, and only two chapters in each of the two following volumes. This preparation will qualify you (as an experience of ten years has shown me in the case of several practicians) to read the whole of the three remaining volumes dealing with the science of Society.”<sup>†</sup>

The chapters thus selected by Comte as essential amount to twenty-five out of the sixty contained in the *Philosophie Positive*. It is hoped that an English version of them will be gradually completed. The present little volume is a first instalment. It contains the two introductory chapters, the first dealing with the Law of Intellectual Evolution, the second with the complementary Law of Classification; the two taken together forming the basis of the Positive Philosophy. In the French these two chapters have already been published separately by Littré. I have carefully compared the present translation with the original, and can bear testimony to its accuracy. I think, too, that it often affords the kind of help which I have said is desirable.

E. S. BEESLY.

<sup>\*</sup> Tenth letter to M. Papot.

<sup>†</sup> Eleventh letter to M. Deullin.

## TRANSLATORS' NOTE

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THE Author's Preface and Part I. were translated by Paul Descours.

The Synoptical Table and Part II. were translated by H. Gordon Jones, who also supplied the Analytical Table of Contents.

P. D.

H. G. J.

*June, 1905.*



## AUTHOR'S PREFACE

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THIS course of lectures was first begun in April, 1826, and is the outcome of all my studies since I left the Polytechnic School in 1816. I was only able to give a few lectures at that time, because I had a serious illness; but I had the honour of having among my audience several scientific men of the first rank, among whom I may mention MM. Alexander von Humboldt, Blainville, and Poinso, members of the Academy of Sciences, who were good enough to follow the course with unflagging interest. However, I gave the whole course last winter, the first lecture taking place on January 4th, 1829. My audience included MM. Fourier (Perpetual Secretary of the Academy of Sciences), Blainville, Poinso, and Navier (members of the same Academy), also Professors Broussais, Esquirol, Binet, etc.; all of whom I must here publicly thank for the way in which they welcomed this new philosophical scheme.

Encouraged by their approval, I thought that this course might with advantage be made more widely known, and I am giving it again this winter at the Royal Athenæum of Paris, where I began the lectures on December 9th.

The plan of the course has remained the same; but in such a place it was necessary to omit some of the developments of my course. They are, however, given in this work in full just as the lectures were delivered last year.

In order to complete this historical account, I must say that some of the fundamental ideas expounded in this course had already been expressed by me, in the first part of a work called *System of Positive Polity*, of which an edition of one hundred copies was printed in May, 1822, and a larger edition afterwards in April, 1824. This first part has not yet been formally published, but copies have been presented to a large number of European scientists and philosophers. It will only be published with the second part, which will, I hope, appear towards the end of 1830.

I have thought it necessary here to state the facts as to the publicity of this first work, because some ideas which somewhat resemble mine are expounded in several works which have been since published, especially as regards the renovation of social theories, though no mention is made of my researches. Although the history of the human mind shows that different persons may, quite independently, arrive separately at similar conclusions while working at the same kind of studies, yet I am obliged to insist on the real priority of a work little known by the world, because it might otherwise be thought that I had found the germ of certain ideas in writings which are really more recent than mine.

As I have on several occasions been



asked for some explanations referring to the title of this course, I think it may be useful to briefly explain it.

The expression *positive philosophy* is constantly used throughout this course, and always with strictly the same meaning. I think, therefore, it would be superfluous to define it otherwise than by the uniform use I have made of it. The whole of the first chapter in particular may be considered as a development of the exact definition of what I mean by the phrase "positive philosophy."

I regret, however, to have been obliged to employ, for want of another, a word like *philosophy*, which has been so improperly used in a multitude of different meanings. But the qualifying adjective *positive* appears to me to clearly prevent any misconception, at all events on the part of those who know its proper meaning. I will, therefore, in this Preface simply say that I use the word *philosophy* in the sense in which it was employed by the ancients, and especially by Aristotle, as comprising the general system of human conceptions; and by adding the word *positive* I wish to denote that I am considering that particular manner of philosophising which holds that the purpose of theories, in any class of ideas, is to co-ordinate facts. This is the third and last state of general philosophy, the first being theological, and

the second metaphysical, as I shall explain in the first chapter.

There is no doubt a good deal of analogy between my Positive Philosophy and what English scientists, especially since the time of Newton, mean by "natural philosophy." But I was unable to use the latter phrase or the term "philosophy of the sciences," which would be perhaps still more precise, because neither of them is yet understood to include all classes of phenomena. On the other hand, the Positive Philosophy, by which I understand the study of social phenomena as well as of all others, refers to a uniform mode of reasoning on all subjects open to human investigation. Besides, the expression "natural philosophy" is used in England to designate the different sciences of observation, considered in the greatest detail; while by Positive Philosophy as compared to the Positive Sciences, I mean only the special study of the generalities of the different sciences—looked upon as following one method and as constituting the different parts of a general scheme of researches. The expression which I have been led to construct is, therefore, both wider and more restricted than the other two expressions, which, being analogous as to the fundamental character of the ideas, might at first sight be considered as equivalent.

AUGUSTE COMTE.

Paris, December 18th, 1829.

# SYNOPTICAL TABLE

OF THE WHOLE COURSE OF POSITIVE PHILOSOPHY BY AUGUSTE COMTE (FORMER  
PUPIL OF THE POLYTECHNIC SCHOOL).<sup>1</sup>

		Lec- tures.			Lec- tures.			Lec- tures.			
General consider- ations	.. 2	{	1. Explanation of the object of this course, or general con- siderations on the nature and importance of the Posi- tive Philosophy.		{	2. Explanation of the plan of this course, or general con- siderations on the hierarchy of the Positive Sciences.		{			
Mathematics	.. 16	{	Philosophical considerations on Mathematics as a whole		{	1. General view of Mathematical Analysis .. .. .		{			
			{	General considerations on		{	2. The Calculus of Direct Functions .. .. .		{		
Astronomy	.. 9	{	Philosophical considerations on Astronomy as a whole		{	1. General exposition of methods of observa- tion .. .. .		{			
			{	General considerations on		{	2. Study of the elementary geometrical pheno- mena .. .. .		{		
Physics	.. 9	{	Considerations on positive Cosmogony .. .. .		{	1. Experimental study of the phenomena of heat .. .. .		{			
			{	General considerations on		{	2. Mathematical theory of these phenomena .. .. .		{		
Chemistry	.. 6	{	Philosophical considerations on Chemistry as a whole		{	1. General view of Inorganic Chemistry .. .. .		{			
			{	General considerations on		{	2. The doctrine of Definite Proportions .. .. .		{		
Physiology	.. 12	{	Philosophical considerations on Physiology as a whole		{	1. Examination of the older theories .. .. .		{			
			{	General considerations on		{	2. Explanation of the positive theory .. .. .		{		
Social Physics	15	{	Introduction .. .. .		{	1. General considerations on the necessity and opportuneness of Social Physics .. .. .		{			
			{	Method .. .. .		{	2. Examination of the principal attempts made hitherto to establish such a science .. .. .		{		
General Summary and Conclusion	3	{	1. Summary of the Positive Method.		{	2. Summary of the Positive Doctrine.		{			
			2. Summary of the Positive Doctrine.			3. Future of the Positive Philosophy.					

<sup>1</sup> This Table represents the oral course, which was in seventy-two lectures, and not the written course, which is in sixty.



# ANALYTICAL TABLE OF CONTENTS

## PART I.

### THE NATURE AND IMPORTANCE OF THE POSITIVE PHILOSOPHY

- 1-3. Preliminary considerations.
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5. Character of the Theological State.
6. " " Metaphysical State.
7. " " Positive State.
8. The final stage of each of the three systems of Philosophy.
10. Truth of the Law proved by the history of the sciences.
11. Individual experience as a proof of the Law.
12. The necessity for the Three States can also be shown as a matter of theory.
- 13-14. It is necessary to observe facts in order to form a theory; and, on the other hand, it is equally necessary to have a theory in order to observe facts.
15. Hence the necessity for the theological character of the primitive philosophy.
16. Theological philosophy is also specially suited to the character of the primitive mind, which prefers to discuss insoluble and inaccessible questions.
17. This form of philosophy afforded a powerful stimulus to early research.
18. Such a stimulus was absolutely necessary at first, although now no longer needed.
20. The theological form of philosophy was • therefore necessary as a provisional method and doctrine.
21. It was impossible to pass directly from the Theological to the Positive state; the transition was effected by the Metaphysical state. Character of this transition.
- 22-23. The Positive Philosophy rejects the search into ultimate *causes*, and confines itself to the investigation of *laws*.
24. The Law of Gravitation as an example of scientific *law*.
25. Fourier's researches on Heat as another example.
- 26-27. The various sciences have passed through the three states at different rates. The order in which the sciences reached the positive state is as follows: Astronomy, Physics, Chemistry, and Physiology. This order is determined by the degree of generality, of simplicity, and independence of the respective phenomena.
28. History of the Positive Philosophy.
29. The growing influence of this philosophy accompanied by the decadence of the two other forms of philosophy. The Positive Philosophy is destined to prevail universally.
30. It does not, however, yet embrace all classes of phenomena.
31. Social phenomena are still treated by theological and metaphysical methods.
32. The Positive Philosophy must, therefore, be completed by the addition of a new science—Social Physics. The first and special aim of this work is to found such a science.
33. With this addition the Positive Philosophy will acquire the character of universality. It will therefore be able to completely displace its two rivals.
- 34-35. The second and general aim of this work is to constitute a philosophy of the sciences by exhibiting them as branches of a single trunk.
36. The course will be one on Positive Philosophy, and not on the Positive Sciences. Only the methods, chief results, and mutual relations of the sciences will be considered, not their details.

37. The two aims of this work are inseparable, although distinct. Without Social Physics the Philosophy would be incomplete; on the other hand, Social Physics must be based upon the other sciences.
38. No fundamental science must, therefore, be omitted from our study.
- 39-40. The present development of the sciences is due to the division of intellectual labour among scientists.
41. But this division has its drawbacks, for it gives rise to excessive specialisation.
42. The remedy for this evil is the creation of a new class of students. Their business would be to deal with the generalities of science. They would connect the various special discoveries with the general system.
43. The principle of division of labour would, therefore, be carried a step further, since the mutual relations of the sciences would thus give rise to a new order of specialists.
45. Four general advantages of the Positive Philosophy.
46. (1) First advantage—it exhibits the logical laws of the human mind.
47. Every living being has two aspects—the Statical and Dynamical.
48. Application of this fact to intellectual phenomena. Psychology must be based on Physiology, and on a study of scientific theories viewed as intellectual products.
49. The unsoundness of introspective psychology.
- 50-52. This kind of psychology is based on an illusion. The organ observed and the observing organ being identical, no proper observations can be made.
53. Introspective psychology is also self-contradictory.
54. There is no agreement among its followers.
55. What little we owe to these men is due to their being unfaithful to their own method.
- 56-57. To understand the Positive Method properly we must study its applications in the various sciences.
58. Such study is essential for the formation of good intellectual habits.
59. The first great result of the Positive Philosophy is, then, to give us a knowledge of intellectual laws and sound rules for the investigation of truth.
60. (2) A second advantage resulting from it will be the regeneration of Education.
61. The present system of teaching the sciences is too specialised. What is wanted is a knowledge of the chief methods and results of the sciences.
62. (3) Third advantage—the progress of the sciences will be advanced by combining them.
63. Many problems need for their solution a combination of two or more sciences.
64. Descartes's discovery of Analytical Geometry—*e.g.*, was due to a combination of Geometry with Algebra.
- 65-66. Further example—many chemical problems need a union of Physiology with Chemistry.
68. (4) Fourth advantage—a solid basis will be provided for the Reorganisation of Society.
- 69-70. The Social Order rests upon Ideas or Opinions. But there is a lack of agreement upon First Principles. Hence the prevalent social disorder.
71. This disorder is due to the simultaneous existence of three incompatible philosophies—the theological, metaphysical, and the positive. The Positive Philosophy is destined to prevail. We have only to complete it by the addition of Social Physics.
72. It has discredited its rivals completely.
75. All attempts at the universal explanation of phenomena by a single law are chimerical.
76. It will therefore be impossible to obtain scientific perfection in this respect. Even the law of gravitation, *e.g.*, cannot give us scientific unity.
77. The only necessary Unity is that of Method. It is sufficient that the doctrine should be *homogeneous*.
78. The object, general character, and influence of the Positive Philosophy have now been described.
79. The next step is to determine the general plan of the work.

## PART II.

## THE CLASSIFICATION OF THE SCIENCES

- 1-2. All existing Classifications of the Sciences are defective.
3. This is partly due to ignorance of the sciences on the part of the classifiers. The chief reason is, however, the want of homogeneity in the intellectual system. The first condition of success was that all our principal conceptions should become positive in character.
4. This condition has now been fulfilled.
5. The True Principle of Classification.
6. Our classification must be based upon the mutual dependence of the sciences. This dependence results from that of the corresponding phenomena with which the sciences deal.
7. The limits of the proposed classification must first be determined.
8. Human knowledge is divided into two branches—Theoretical and Practical. This inquiry deals only with Theoretical knowledge.
9. A knowledge of the laws of phenomena enables us to act effectively upon nature. Science is, therefore, the basis of the Arts.
10. But Science has the still more important function of satisfying our mental craving to know the laws of phenomena.
11. The study of science for its own sake has in the past led to numerous improvements in the Arts.
12. We are concerned here only with Theory, leaving its practical applications on one side.
13. To unite the generalities of both Theory and Practice in the same course would at present be out of the question. The special theories of the Arts have, in fact, not yet been formed.
14. The class of engineers has to settle the relations between Theory and Practice. But scientific theories of the Arts are as yet incoherent and scattered.
15. Every Art needs a combination of several Sciences. Hence the true theories of the Arts must be a future consequence arising out of the construction of the Positive Philosophy.
- 16-17. We must further distinguish two classes of natural Sciences—the Abstract and Concrete. We are concerned only with the Abstract Sciences.
- 18-19. Physiology, *e.g.*, will be dealt with, but not Botany or Zoology.
20. Chemistry comes into our scheme, but not Mineralogy.
- 21-23. The Concrete Sciences, like the Theories of the Arts, are based upon the Abstract Sciences. They must therefore be omitted.
24. General conclusion — Theory alone concerns us in this work, and Theory of an Abstract kind only.
25. The next step is to classify the Sciences.
- 26-27. Our classification cannot be a perfect one.
28. Reasons for this necessary imperfection. The Historical and Dogmatic methods of studying a science.
29. Nature of the Historical Method.
30. Nature of the Dogmatic Method.
31. New sciences must be studied by the Historical Method
32. The more advanced sciences only admit of the Dogmatic Method being used.
33. Example of the two Methods—the education of an ancient geometer compared with that of a modern geometer.
34. The Dogmatic Method is constantly superseding the other method.
35. It places even an average intellect in possession of all the work of past generations.
36. Sciences in an advanced state must be learned by a use of the Dogmatic Method, combined with the Historical Method in the case of the most recent discoveries.
37. The Dogmatic Method does not show how the sciences were built up, but that is also true of the ordinary Historical Method.
- 38-39. The true history of the progress of a science belongs to Social Science.

40. No science can be properly understood apart from its history. Therefore the subject will be treated incidentally throughout the course. The true study of the history of the sciences is, however, reserved for Social Physics.
42. It is impossible to adhere strictly to the historical order in an exposition of the sciences, for an earlier often borrows from a later science.
43. Astronomy and Physics as an example.
44. Such defects are due to the artificial element in our classification.
45. The classification, however, agrees in the main with the history of science.
- 46-47. There are 720 possible ways of arranging the six fundamental sciences. The problem is to find the one order which fulfils the necessary conditions.
48. The true principle of classification must be obtained by a comparison of the different order of phenomena with which these sciences deal.
49. So compared, we find that the sciences can be arranged in an order of mutual dependence. This order is determined by the degree of simplicity or generality of the respective phenomena.
50. The most simple are necessarily also the most general phenomena. The order is, then, from the most simple or general to the most complex and special phenomena.
51. The simplest sciences, being the furthest removed from the human order, have naturally been the earliest to develop.
52. We can now proceed to the actual construction of the encyclopædic scale.
53. Two classes of phenomena—Inorganic and Organic.
54. Organic phenomena are more complex and less general than Inorganic. They also depend upon the Inorganic. Therefore, the study of Inorganic phenomena must precede the other.
55. This division into Inorganic and Organic will not be affected by any further modification of our views as to the nature of living bodies, should such take place.
56. In any case, we know that the one order of phenomena depends upon the other.
58. Inorganic Physics must be divided into Astronomy and Terrestrial Physics.
59. Nature of Astronomical phenomena. Their study must precede that of Terrestrial Physics.
60. Terrestrial Physics must be further divided into Physics proper and Chemistry. Chemical phenomena are more special than physical. Physics must, therefore, precede Chemistry.
- 61-62. Organic phenomena are divided into those relating to the individual and those dealing with the species. In the case of Man this distinction is a fundamental one. Hence Organic Physics is divided into Physiology proper and Social Physics.
63. Social Physics is not a mere appendage to Physiology. Although based upon Physiology, it is a separate science. Social laws cannot be deduced from physiological ones.
64. Physiology can be divided into vegetable and animal. But for our present purpose this division is inapplicable.
65. Physiology, therefore, will be regarded as a single science in this work.
66. Hence the order of the sciences is—Astronomy, Physics, Chemistry, Physiology, and Social Physics. This order exhibits a regular gradation from the most general, simple, and abstract phenomena to the most special, complex, and concrete.
67. The sub-divisions of each science may also be arranged on the same principle.
68. The chief characteristic properties of this classification are four in number.
69. (1) This classification agrees with the existing empirical classification which has spontaneously arisen among scientists.
70. Such an accordance is the surest sign of a good classification.
71. But the accordance does not in the least degree make the performance of our encyclopædic task unnecessary.
72. (2) This classification follows the historical order of development of the sciences.
73. That order was necessitated by the fact that the later sciences could not be constituted, until a considerable development of the earlier ones, upon which they depended, had taken place.

74. It is impossible to verify the Law of the Three States properly unless we combine it with this encyclopædic formula.
75. (3) This classification marks the degree of perfection of each science.
76. The most perfect sciences are those which are least dependent on the other sciences, and *vice versa*.
77. The great means of perfecting a science is Mathematical Analysis. The sciences admit of the application of Mathematics in proportion as they are occupied with very simple and general phenomena.
78. The difference between the degree of precision which a science admits of and its certainty. All the sciences are equally certain; they only differ in their degree of precision.
79. (4) This classification furnishes us with the plan of a really Scientific Education—general and special.
80. (a) The effect of the classification on Doctrine. No science can be properly studied without a knowledge of the sciences preceding it in our classification. This principle is especially applicable to the case of the special education of scientists.
81. Examples of the need for an orderly study of the sciences.
82. At present a really rational scientific education does not exist. Hence the imperfect condition of the more important sciences.
83. The need for this orderly study is just as necessary in respect of general education.
84. (b) We must consider the encyclopædic formula from the standpoint of Method as well as Doctrine.
85. The proposed course will result in giving us a perfect knowledge of the Positive Method.
86. By studying the sciences in the proposed order, we shall obtain a knowledge of the various modifications which the general Positive Method undergoes.
87. Although the general method is the same in all cases, each science contributes a special development of its characteristic procedures.
88. A study of all the fundamental sciences is therefore indispensable.
89. Not only must all the sciences be studied, but they must also be studied in their proper order.
90. The importance of the proposed classification has now been dealt with under four aspects.
91. But Mathematics has been omitted from the scale of the sciences.
92. This omission was intentional, on account of the extreme importance of that science. Its general character and encyclopædic rank will form the subject of the next chapter. The general conclusions of that chapter are, however, given here.
93. Mathematics is not a mere part of natural philosophy; it is really its basis. It is of more importance as Method than as Doctrine.
94. It must be divided into Abstract Mathematics, or the Calculus, and Concrete Mathematics. Concrete Mathematics consists of General Geometry and Rational Mechanics.
95. Abstract Mathematics is purely instrumental. Geometry and Mechanics are true natural sciences. But they are more important as Method than as Doctrine.
96. Mathematics must be placed at the head of the Positive Philosophy. This is in accordance with our general principle of classification. This science has long been the starting-point of a scientific education. We now see the rational grounds for this practice.
97. The plan which must guide us in our study of Positive Philosophy has now been laid down. The true encyclopædic formula which we must follow is, therefore—Mathematics, Astronomy, Physics, Chemistry, Physiology, and Social Physics.
98. This chapter has then justified the preceding Synoptical Table. In constructing this Synoptical Table, the sub-divisions of each science have been arranged in accordance with the same principle of classification which furnished the encyclopædic scale itself.





# The Fundamental Principles of the Positive Philosophy

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## PART I. •

### EXPLANATION OF THE OBJECT OF THIS COURSE, OR GENERAL CONSIDERATIONS ON THE NATURE AND IMPORTANCE OF THE POSITIVE PHILOSOPHY

1. THE object of this first chapter is to indicate clearly the purpose of the course, by an exact determination of the spirit in which we shall consider the various fundamental branches of natural philosophy, set forth in the preceding Synoptical Table.

2. It is true that the nature of this course can only be completely realised, so as to enable us to form a definite opinion of it, when its different parts have been developed in due order. That is the usual disadvantage of definitions relating to very extensive systems of ideas, when the definition precedes the exposition. But general principles may be conceived under two aspects—either as the sketch of a doctrine which it is proposed to establish, or as the summary of an already-established doctrine. It is true that it is only from the last point of view that they acquire their full value, yet they already possess under the first aspect an extreme importance, since they serve to characterise from the out-

set the subject to be considered. The general limitation of the field of our researches—carried out with the utmost strictness—is a preliminary mental operation, which is especially necessary in a study so vast, and hitherto so indeterminate, as that which we are about to undertake. In order to comply with this logical necessity, I think it necessary to begin by at once pointing out the series of fundamental considerations which gave rise to this course; they will be subsequently specially developed with all the detail which their great importance demands.

3. In order to explain properly the true nature and peculiar character of the Positive Philosophy, it is indispensable that we should first take a brief survey of the progressive growth of the human mind, viewed as a whole; for no idea can be properly understood apart from its history.

4. In thus studying the total development of human intelligence in its different

spheres of activity, from its first and simplest beginning up to our own time, I believe that I have discovered a great fundamental Law, to which the mind is subjected by an invariable necessity. The truth of this Law can, I think, be demonstrated both by reasoned proofs furnished by a knowledge of our mental organisation, and by historical verification due to an attentive study of the past. This Law consists in the fact that each of our principal conceptions, each branch of our knowledge, passes in succession through three different theoretical states: the Theological or fictitious state, the Metaphysical or abstract state, and the Scientific or positive state. In other words, the human mind—by its very nature—makes use successively in each of its researches of three methods of philosophising, whose characters are essentially different, and even radically opposed to each other. We have first the Theological method, then the Metaphysical method, and finally the Positive method. Hence there are three kinds of philosophy or general systems of conceptions on the aggregate of phenomena, which are mutually exclusive of each other. The first is the necessary starting-point of human intelligence: the third represents its fixed and definitive state: the second is only destined to serve as a transitional method.

5. In the Theological state, the human mind directs its researches mainly towards the inner nature of beings, and towards the first and final causes of all the phenomena which it observes—in a word, towards Absolute knowledge. It therefore represents these phenomena as being produced by the direct and continuous action of more or less numerous supernatural agents, whose arbitrary

intervention explains all the apparent anomalies of the universe.

6. In the Metaphysical state, which is in reality only a simple general modification of the first state, the supernatural agents are replaced by abstract forces, real entities or personified abstractions, inherent in the different beings of the world. These entities are looked upon as capable of giving rise by themselves to all the phenomena observed, each phenomenon being explained by assigning it to its corresponding entity.

7. Finally, in the Positive state, the human mind, recognising the impossibility of obtaining absolute truth, gives up the search after the origin and destination of the universe and a knowledge of the final causes of phenomena. It only endeavours now to discover, by a well-combined use of reasoning and observation, the actual *laws* of phenomena—that is to say, their invariable relations of succession and likeness. The explanation of facts, thus reduced to its real terms, consists henceforth only in the connection established between different particular phenomena and some general facts, the number of which the progress of science tends more and more to diminish.

8. The Theological system arrived at its highest form of perfection, when it substituted the providential action of a single being, for the varied play of the numerous independent gods which had been imagined by the primitive mind. In the same way, the last stage of the Metaphysical system consisted in replacing the different special entities by the idea of a single great general entity—Nature—looked upon as the sole source of all phenomena. Similarly, the ideal of the Positive system, towards which it constantly tends, although in

all probability it will never attain such a stage, would be reached if we could look upon all the different phenomena observable as so many particular cases of a single general fact, such as that of Gravitation, for example.

9. This is not the place to give a special demonstration of this fundamental Law of Mental Development, and to deduce from it its most important consequences. We shall make a direct study of it, with all the necessary details, in the part of this work relating to social phenomena.<sup>1</sup> I am only considering it now in order to determine precisely the true character of the Positive Philosophy, as opposed to the two other philosophies which have successively dominated our whole intellectual system up to these latter centuries. For the present, to avoid leaving entirely undemonstrated so important a law, the applications of which will frequently occur throughout this work, I must confine myself to a rapid enumeration of the most evident general reasons which prove its exactitude.

10. In the first place, it is, I think, sufficient merely to enumerate such a law for its accuracy to be immediately verified, by all those who are fairly well acquainted with the general history of the sciences. For there is not a single science which has to-day reached the Positive stage, which was not in the past—as each can easily see for himself—composed mainly of metaphysical abstrac-

tions, and, going back further still, it was altogether under the sway of theological conceptions. Unfortunately, we shall have to recognise on more than one occasion in the different parts of this course, that even the most perfect sciences still retain to-day some very evident traces of these two primitive states.

11. This general revolution of the human mind can, moreover, be easily verified to-day, in a very obvious, although indirect, manner, if we consider the development of the individual intelligence. The starting-point being necessarily the same in the education of the individual as in that of the race, the various principal phases of the former must reproduce the fundamental epochs of the latter. Now, does not each of us in contemplating his own history recollect that he has been successively—as regards the most important ideas—a *theologian* in childhood, a *metaphysician* in youth, and a *natural philosopher* in manhood? This verification of the law can easily be made by all who are on a level with their age.

12. But, in addition to the proofs of the truth of this law furnished by direct observation of the race or the individual, I must, above all, mention in this brief summary the theoretical considerations which show its necessity.

13. The most important of these considerations arises from the very nature of the subject itself. It consists in the need at every epoch of having some theory to connect the facts, while, on the other hand, it was clearly impossible for the primitive human mind to form theories based on observation.

14. All competent thinkers agree with Bacon that there can be no real knowledge except that which rests upon observed facts. This fundamental

<sup>1</sup> Readers who desire to have a fuller explanation of this subject, without delay, may consult with advantage three articles entitled "Philosophical Considerations on the Sciences and Men of Science," which I published in November, 1825, in a journal called the *Producteur* (numbers seven, eight, and ten), and especially the first part of my *System of Positive Polity*, addressed in April, 1824, to the Academy of Sciences, where I placed on record for the first time my discovery of this Law.

maxim is evidently indisputable if it is applied, as it ought to be, to the mature state of our intelligence. But, if we consider the origin of our knowledge, it is no less certain that the primitive human mind could not, and indeed ought not to, have thought in that way. For if, on the one hand, every Positive theory must necessarily be founded upon observations, it is, on the other hand, no less true that, in order to observe, our mind has need of some theory or other. If in contemplating phenomena we did not immediately connect them with some principles, not only would it be impossible for us to combine these isolated observations, and therefore to derive any profit from them, but we should even be entirely incapable of remembering the facts, which would for the most part remain unnoted by us.

15. Thus there were two difficulties to be overcome: the human mind had to observe in order to form real theories, and yet had to form theories of some sort before it could apply itself to a connected series of observations. The primitive human mind, therefore, found itself involved in a vicious circle, from which it would never have had any means of escaping, if a natural way out of the difficulty had not fortunately been found by the spontaneous development of Theological conceptions. These presented a rallying-point for the efforts of the mind, and furnished materials for its activity. This is the fundamental motive which demonstrates the logical necessity for the purely Theological character of Primitive Philosophy, apart from those important social considerations relating to the matter which I cannot even indicate now.

16. This necessity becomes still more evident, when we have regard to the

perfect congruity of Theological Philosophy, with the peculiar nature of the researches on which the human mind, in its infancy, concentrated to so high a degree all its powers. It is, indeed, very noticeable how the most insoluble questions—such as the inner nature of objects, or the origin and purpose of all phenomena—are precisely those which the human mind proposes to itself, in preference to all others, in its primitive state; all really soluble problems being looked upon as hardly worthy of serious thought. The reason for this is very obvious, since it is experience alone which has enabled us to estimate our abilities rightly, and if man had not commenced by over-estimating his forces, these would never have been able to acquire all the development of which they are capable. This fact is a necessity of our organisation. But, be that as it may, let us picture to ourselves as far as we can this early mental disposition, so universal and so prominent, and let us ask ourselves what kind of reception would have been accorded at such an epoch to the Positive Philosophy, supposing it to have been then formed. The highest ambition of this Philosophy is to discover the *laws* of phenomena, and its main characteristic is precisely that of regarding as necessarily interdicted to the human reason, all those sublime mysteries which Theological Philosophy, on the contrary, explains with such admirable facility, even to the smallest detail. Under such circumstances, it is easy to see what the choice of primitive man would be.

17. The same thing is true, when we consider from a practical standpoint the nature of the pursuits which the human mind first occupies itself with. Under that aspect, they offer to man the strong

attraction of an unlimited control over the exterior world, which is regarded as being entirely destined for our use, while all its phenomena seem to have close and continuous relations with our existence. These chimerical hopes, these exaggerated ideas of man's importance in the universe, to which the Theological Philosophy gives rise, are destroyed irrevocably by the first-fruits of the Positive Philosophy. But, at the commencement, they afforded an indispensable stimulus without the aid of which we cannot, indeed, conceive how the primitive human mind would have been induced to undertake any arduous labours.

18. We are at the present time so far removed from that early state of mind—at least as regards the majority of phenomena—that it is difficult for us to appreciate properly the force and necessity of such considerations. Human reason is now so mature that we are able to undertake laborious scientific researches, without having in view any extraneous goal capable of strongly exciting the imagination, such as that which the astrologers or alchemists proposed to themselves. Our intellectual activity is sufficiently excited by the mere hope of discovering the laws of phenomena, by the simple desire of verifying or disproving a theory. This, however, could not be the case in the infancy of the human mind. Without the attractive chimeras of Astrology, or the powerful deceptions of Alchemy, for example, where should we have found the perseverance and ardour necessary for collecting the long series of observations and experiments which, later on, served as a basis for the first Positive theories of these two classes of phenomena?

19. The need of such a stimulus to our intellectual development was keenly felt long ago by Kepler in the case of astronomy, and has been justly appreciated in our own time by Berthollet in chemistry.

20. The above considerations show us that, although the Positive Philosophy represents the true final state of human intelligence—that to which it has always tended more and more—it was none the less necessary to employ the Theological Philosophy at first and during many centuries, both as a method and as furnishing provisional doctrines. Since the Theological Philosophy is spontaneous in its character, it is, for that reason, the only one possible in the beginning; it is also the only one which can offer a sufficient interest to our budding intelligence. It is now very easy to see that, in order to pass from this provisional form of philosophy to the final stage, the human mind was naturally obliged to adopt Metaphysical methods and doctrines as a transitional form of philosophy. This last consideration is indispensable, in order to complete the general sketch of the great law which I have pointed out.

21. It is easily seen that our understanding, which was compelled to progress by almost insensible steps, could not pass suddenly, and without any intermediate stages, from Theological to Positive philosophy. Theology and Physics are so profoundly incompatible, their conceptions are so radically opposed in character, that, before giving up the one in order to employ the other exclusively, the human intelligence had to make use of intermediate conceptions, which, being of a hybrid character, were eminently fitted to bring about a gradual transition. That is the part played by

Metaphysical conceptions, and they have no other real use. By substituting, in the study of phenomena, a corresponding inseparable entity for a direct supernatural agency—although, at first, the former was only held to be an offshoot of the latter—Man gradually accustomed himself to consider only the facts themselves. In that way, the ideas of these metaphysical agents gradually became so dim that all right-minded persons only considered them to be the abstract names of the phenomena in question. It is impossible to imagine by what other method our understanding could have passed from frankly supernatural to purely natural considerations, or, in other words, from the Theological to the Positive régime.

22. I have thus established, as far as it is possible to do so without entering into a special discussion, which would be out of place at the present moment, what I conceive to be the general Law of Mental Development. It will now be easy for us to determine precisely the exact nature of the Positive Philosophy. To do that is the special object of this chapter.

23. We have seen that the fundamental character of the Positive Philosophy is to consider all phenomena as subject to invariable natural *Laws*. The exact discovery of these Laws and their reduction to the least possible number constitute the goal of all our efforts; for we regard the search after what are called *causes*, whether first or final, as absolutely inaccessible and unmeaning. It is unnecessary to dwell much on a principle which has now become so familiar to all who have made anything like a serious study of the observational sciences. Everybody, indeed, knows that in our positive explanations, even when they are most complete, we do not pretend to

explain the real *causes* of phenomena, as this would merely throw the difficulty further back; we only try to analyse correctly the circumstances of their production, and to connect them together by normal relations of succession and similarity.

24. Thus, to cite the best example, we say that the general phenomena of the universe are *explained*—as far as they can be—by the Newtonian Law of Gravitation. On the one hand, this admirable theory shows us all the immense variety of astronomical facts as only a single fact looked at from different points of view; that fact being the constant tendency of all molecules towards each other, in direct proportion to their masses and inversely as the squares of their distances. On the other hand, this general fact is shown to be the simple extension of an extremely familiar and, therefore, well-known phenomenon—the weight of a body at the earth's surface. As to determining what attraction and weight are in themselves or what their causes are, these are questions which we regard as insoluble and outside the domain of the Positive Philosophy; we, therefore, rightly abandon them to the imagination of the theologians or the subtleties of the metaphysicians. That it is clearly impossible to solve such questions is shown by the fact that, whenever an attempt has been made to give a rational explanation of the matter, the greatest thinkers have only been able to define one of these principles by the other. Attraction is defined as nothing else than universal weight, and weight is said to consist simply in terrestrial attraction. Explanations of this kind raise a smile, if put forward as furnishing us with a knowledge of “things-in-themselves” and the mode of causation of phenomena. They

are, however, the only satisfactory results obtainable, for they present as identical two orders of phenomena which were for so long a time regarded as unconnected. No sensible person would nowadays seek to go beyond this.

25. It would be easy to multiply these examples, which will occur very frequently throughout this treatise, for at the present day all great intellectual operations are conducted in this spirit. To take a single example of this from contemporary works, I will choose the fine series of researches made by Fourier on the Theory of Heat. This affords us an excellent verification of the preceding general remarks. In this work, the philosophical character of which is so eminently positive, the most important and most precise laws of thermal phenomena are disclosed; but the author has not once inquired into the intimate nature of Heat in itself, nor has he mentioned, except to point out its uselessness, the warm controversy between the partisans of Heat as a material substance and those who make it consist in the vibrations of an universal ether. And yet that work treats of the most important questions, several of which had never even been raised before; a clear proof that the human mind, by simply confining itself to researches of an entirely positive order, can find therein inexhaustible food for its highest form of activity, without attacking inaccessible problems.

26. Having thus indicated, so far as it was possible to do so in this general sketch, the spirit of the Positive Philosophy, which the whole of this course is intended to develop, we must next consider what stage in the formation of that Philosophy has now been reached, and what remains to be done in order to constitute it fully.

27. For this purpose, we must, in the first place, remember that the different branches of our knowledge were not able to pass at the same rate through the three great phases of their development indicated above, and that consequently they did not arrive simultaneously at the Positive state. There exists in this respect an invariable and necessary Order which our various classes of conceptions have followed, and were bound to follow, in their progressive course; and the exact consideration of this Order is the indispensable complement of the fundamental mental law previously enunciated. That Order will form the special subject of the next chapter. At present it is sufficient to know that it conforms to the diverse nature of the phenomena, and that it is determined by their degree of generality, of simplicity, and of reciprocal independence—three considerations which, although quite distinct, lead up to the same result. Thus, Astronomical phenomena, being the most general, the simplest, and the most independent of all others, were the first to be subjected to positive theories; then followed in succession and for the same reasons the phenomena of Terrestrial Physics, properly so called, those of Chemistry, and finally Physiological phenomena.

28. It is impossible to fix the precise date of this mental revolution; we can only say that, like all other great human events, it took place continuously and at an increasing rate, especially since the labours of Aristotle and the Alexandrian school, and afterwards from the introduction of natural science into the West of Europe by the Arabs. However, as it is better to fix an epoch in order to give greater precision to our ideas, I would select that of the great movement imparted to the human intellect two centuries



ago, by the combined influence of the precepts of Bacon, the conceptions of Descartes, and the discoveries of Galileo. It was then that the spirit of the Positive Philosophy began to assert itself in the world, in evident opposition to the Theological and Metaphysical spirit; for it was then that Positive conceptions disengaged themselves clearly from the superstitious and scholastic alloy, which had more or less disguised the true character of all the previous scientific work.

29. Since that memorable epoch, the increasing influence of the Positive Philosophy and the decadent movement of Theological and Metaphysical Philosophy have been extremely marked. These movements have at last become so pronounced that, at the present day, it is impossible for any observer acquainted with the spirit of his age, to fail to recognise the final bent of the human mind towards Positive studies, and the irrevocable break henceforth from those fruitless doctrines and provisional methods which were only suited to its first flight. This fundamental mental revolution will therefore necessarily be carried out to the fullest extent. If, then, there still remains some great conquest to be made, some important division of the intellectual domain to be invaded, we can be certain that the transformation will take place there also, as it has been carried out in all the other branches of science. It would evidently be absurd to suppose that the human mind, which is so disposed to unity of method, would yet preserve indefinitely, in the case of a single class of phenomena, its primitive mode of philosophising, when it has once adopted for the other classes a new philosophic path of an entirely opposite character.

30. The whole thing reduces itself, therefore, to a simple question of fact. Does the Positive Philosophy, which, during the last two centuries, has gradually acquired so great an extension, embrace at the present day all classes of phenomena? It is evident that it does not; and there still remains, therefore, a great scientific work to be executed, in order to give the Positive Philosophy that universal character indispensable for its final constitution.

31. In the four principal categories of natural phenomena enumerated above, astronomical, physical, chemical, and physiological, we notice an important omission relating to social phenomena. Although these are implicitly comprised among physiological phenomena, yet, owing to their importance and the inherent difficulties of their study, they deserve to form a distinct class. This last order of ideas is concerned with the most special, most complicated, and most dependent of all phenomena; it has, therefore, necessarily progressed more slowly than all the preceding orders, even if we do not take into account the more special obstacles to its study which we shall consider later on. However that may be, it is evident that it has not yet been included within the domain of Positive philosophy. Theological and metaphysical methods are never used now by anyone in dealing with all the other kinds of phenomena, either as a means of investigation or even as a mode of reasoning. But these discarded methods are, on the contrary, still exclusively used for both purposes in everything which concerns social phenomena, although their insufficiency in this respect has been already fully felt by all good judges, such men being tired of these empty and endless

discussions about divine right and the sovereignty of the people.

32. Here, then, is the great, but evidently the only, gap which has to be filled up in order to finish the construction of the Positive philosophy. Now that the human mind has founded celestial physics, terrestrial physics (mechanical and chemical), and organic physics (vegetable and animal), it only remains to complete the system of observational sciences by the foundation of Social Physics. This is at the present time, under several important aspects, the greatest and most pressing of our mental needs, and to meet this need is, I make bold to say, the first purpose of this work, its special object.

33. The conceptions which I shall endeavour to present relating to the study of social phenomena, and of which I hope that the present chapter will already enable us to see the germ, cannot be expected to raise Social Physics at once to the degree of perfection which has been reached by the earlier branches of natural philosophy. Such a hope would be evidently chimerical, seeing that these branches still differ widely from one another in perfectness, as was, indeed, inevitable. But I aim at impressing upon this last branch of our knowledge the same Positive character which already marks all the other branches. If this condition is once really fulfilled, the philosophical system of the modern world will be at last founded in its entirety; for there is no observable fact which would not then be included in one or other of the five great categories of astronomical, physical, chemical, physiological, and social phenomena. All our fundamental conceptions having thus been rendered homogeneous, philosophy will be finally con-

stituted in the Positive state. Its character will be henceforth unchangeable, and it will then only have to develop itself indefinitely, by incorporating the constantly-increasing knowledge which inevitably results from new observations or more profound meditations. Having by this means acquired the character of universality which as yet it lacks, the Positive Philosophy, with all its natural superiority, will be able to displace entirely the Theological and Metaphysical philosophies. The only real property possessed by Theology and Metaphysics at the present day is their character of universality, and when deprived of this motive for preference they will have for our successors only an historical interest.

34. The first and special object of this course having been thus set forth, it is easy to comprehend its second and general aim, that which constitutes it a course of Positive Philosophy, and not merely a course on Social Physics.

35. The formation of Social Physics at last completes the system of natural sciences. It, therefore, becomes possible and even necessary to summarise these different sciences, so that they may be co-ordinated by presenting them as so many branches of a single trunk, instead of continuing to look upon them as only so many isolated groups. Therefore, before proceeding to the study of social phenomena, I shall successively consider, in the encyclopædic order given above, the different positive sciences already formed.

36. It is, I think, unnecessary to warn the reader that I do not claim to give here a series of special courses of lectures on each of the principal branches of Natural Philosophy. Not to speak of the enormous time that such an enterprise would take it is clear that I cannot

claim to be equipped for it, nor, I think I may add, can anyone else in the present state of human education. On the contrary, a course of the kind contemplated here requires, if it is to be properly understood, a previous series of special studies on the different sciences which will be treated therein. In the absence of this condition, it is very difficult to realise, and impossible to properly estimate, the philosophical reflections which will be made upon these sciences. In one word, it is a course on Positive Philosophy, and not on the Positive Sciences, that I propose to give. We shall only have to consider here each fundamental science in its relations with the whole positive system, and as to the spirit characterising it; that is to say, under the two-fold aspect of its essential methods and its principal doctrines. As to the doctrines, indeed, I shall often do no more than mention them as known to specialists, though I shall try to estimate their importance. 2422

37. In order to sum up the ideas relating to the two-fold purpose of this course, I must call attention to the two objects—the one special, the other general—which I have in view, and which, although distinct in themselves, are necessarily inseparable. On the one hand, it would be impossible to conceive of a course of Positive Philosophy unless Social Physics had first been founded, since an essential element would then be lacking; consequently, the conceptions of such a course would not have that character of generality which ought to be their principal attribute, and which distinguishes our present study from any series of special studies. On the other hand, how can we proceed with sure step to the positive study of social phenomena, if the mind has not been first pre-

pared by the thorough consideration of positive methods in the case of less complex phenomena, and furnished in addition with a knowledge of the principal laws of earlier phenomena, all of which have a more or less direct influence upon social facts?

38. Although all the fundamental sciences do not inspire ordinary minds with an equal interest, there is not one of them which should be neglected in such a study as we are about to undertake. As regards the welfare of the human race, all of them are certainly of equal importance, when we examine them thoroughly. Besides, those whose results seem at first sight to offer only a minor practical interest are yet of the greatest importance, either owing to the greater perfection of their methods, or as being the indispensable foundation of all the others. This is a consideration to which I shall have special occasion to refer in the next chapter.

39. To guard, as far as possible, against the misconceptions likely to arise respecting a work so novel as this, I must add a few remarks to the explanations already given. I refer especially to that universal predominance of specialism which hasty readers might think was the tendency of this course, and which is so rightly looked upon as wholly contrary to the true spirit of the Positive Philosophy. These remarks will, moreover, have the more important advantage of exhibiting this spirit under a new aspect, calculated to make its general idea clearer.

40. In the primitive state of our knowledge, no regular division exists among intellectual labours; all the sciences are cultivated simultaneously by the same minds. This method of organising human studies is at first inevitable and

even indispensable, as I shall have occasion to show later on; but it gradually changes in proportion as the different orders of conceptions develop themselves. By a law whose necessity is evident, each branch of the scientific system gradually separates from the trunk when it has developed far enough to admit of separate cultivation—that is to say, when it has arrived at a stage in which it is capable of constituting the sole pursuit of certain minds. It is to this division of the various kinds of research among different orders of scientists that we evidently owe the development which each distinct class of human knowledge has attained in our time; but this very division renders it impossible for modern scientists to practise that simultaneous cultivation of all the sciences which was so easy and so common in antiquity. In a word, the division of intellectual labour, carried out further and further, is one of the most important and characteristic attributes of the Positive Philosophy.

41. But, while recognising the prodigious results due to this division, and while seeing that it henceforth constitutes the true fundamental basis of the general organisation of the scientific world, it is, on the other hand, impossible not to be struck by the great inconveniences which it at present produces, on account of the excessive specialisation of the ideas which exclusively occupy each mind. This unfortunate result is no doubt inevitable up to a certain point, as being inherent in the very principle of the division of labour. Do what we will, therefore, we shall never be able to equal the ancients in this respect, for their general superiority was due to the slight degree of development of their knowledge. Yet, I think we can, by proper means, avoid the most pernicious

effects of an exaggerated specialism, without doing injury to the fruitful influence of the division of labour in research. There is an urgent need for considering this question seriously, for these inconveniences, which, by their very nature, tend constantly to increase, are now becoming very apparent. Everyone agrees that the divisions which we establish between the various branches of Natural Philosophy, in order to make our labours more perfect, are at bottom artificial. In spite of this admission, we must not forget that the number of scientists who study the whole even of a single science is already very small, although such a science is, in its turn, only a part of a greater whole. The majority of scientists already confine themselves entirely to the isolated consideration of a more or less extensive section of a particular science, without concerning themselves much about the relation between their special work and the general system of positive knowledge. Let us hasten to remedy this evil before it becomes more serious. Let us take care that the human mind does not finish by losing its way in a mass of detail. We must not conceal from ourselves that this is the essentially weak side of our system, and that this is the point on which the partisans of Theological and Metaphysical philosophy may still attack the Positive Philosophy with some hope of success.

42. The true means of arresting the pernicious influence which seems to threaten the intellectual future of our race, on account of a too great specialisation of individual researches, is clearly not to return to the ancient confusion of labours. This would tend to put the human mind back; and, besides, such a return has happily become impossible

now. The true remedy consists, on the contrary, in perfecting the division of labour itself. All that is necessary is to create one more great speciality, consisting in the study of scientific generalisations. We need a new class of properly-trained scientists, who, instead of devoting themselves to the special study of any particular branch of Natural Philosophy, shall employ themselves solely in the consideration of the different Positive Sciences in their present state. It would be their function to determine exactly the character of each science, to discover the relations and concatenation of the sciences, and to reduce, if possible, all their chief principles to the smallest number of common principles, while always conforming to the fundamental maxims of the Positive Method. At the same time, the other scientists, before devoting themselves to their respective specialities, should have received a previous training embracing all the general principles of positive knowledge. This would enable them henceforth to make immediate use of the light thrown on their work by the scientists devoted to the study of generalities, whose results the specialists would, in turn, be able to rectify. That is a state of things to which the existing scientists are drawing nearer every day. If these two great conditions were once fulfilled, as they evidently can be, then the division of labour in the sciences could be carried on, without any danger, as far as the development of the different kinds of knowledge required. There would be a distinct class of men (always open to the criticism of all the other classes), whose special and permanent function would consist in connecting each new special discovery with the general system; and we should then have no cause to fear

that too great an attention bestowed upon the details would ever prevent us from perceiving the whole. In a word, the modern organisation of the scientific world would then be accomplished, and would be susceptible of indefinite development, while always preserving the same character.

43. To make the study of scientific generalisations a distinct department of intellectual labour is merely a further extension of the same principle of division which led to the successive separation of the different sciences. As long as the different Positive Sciences were only slightly developed, their mutual relations were not important enough to give rise, at all events permanently, to a special class of workers; nor was the need of this new study nearly so urgent as it is now. But, at the present day, each of the sciences has developed on its own lines to such an extent that the examination of their mutual relations affords material for systematic and continued labour, while at the same time this new order of studies becomes indispensable, to prevent the dispersion of human ideas.

44. Such, in my view, is the office of the Positive Philosophy in relation to the Positive Sciences properly so called. Such, at all events, is the aim of the present work.

45. I have now determined, as exactly as it was possible for me to do in a first sketch, the general spirit of a course of Positive Philosophy. In order to bring out its full character, I must state concisely the principal general advantages which such a work may have—if its essential conditions are properly fulfilled—as regards intellectual progress. I will mention only four. They are fundamental qualities of the Positive Philosophy.

46. In the first place, the study of the Positive Philosophy, by considering the results of the activity of our intellectual faculties, furnishes us with the only really rational means of exhibiting the logical laws of the human mind, which have hitherto been sought by methods so ill calculated to reveal them.

47. To explain what I mean on this point, I must first recall a philosophical conception of the highest importance, set forth by Blainville in the fine introduction to his *Principles of Comparative Anatomy*. According to him, every active being, and especially every living being, may be studied in all its manifestations under two fundamental relations—the Statical and the Dynamical; that is, as fitted to act and as actually acting. It is clear that all the considerations which might be presented will necessarily fall under the one or the other of these heads. Let us apply this luminous fundamental maxim to the study of intellectual functions.

48. If these functions are regarded from a Statical point of view, their study can only consist in determining the organic conditions on which they depend; it thus forms an essential part of anatomy and physiology. When considering the question from a Dynamical point of view, we have merely to study the actual march of the human intellect, in practice, by examining the procedures used by it in order to acquire a knowledge of the various sciences; this constitutes essentially the general object of the Positive Philosophy, as I have already defined it in this chapter. In brief, we must look upon all scientific theories as so many great logical facts; and it is only by a thorough observation of these facts that we can rise to the knowledge of logical laws.

49. These are evidently the only two general methods, complementary to each other, by the use of which we are able to arrive at any really rational ideas concerning intellectual phenomena. We see that in no case is there room for that illusory psychology—the last transformation of theology—to revive which attempts are being made so vainly at the present day. This theory, while ignoring and discarding the physiological study of our intellectual organs, and the observation of the rational methods which actually direct our various scientific researches, claims that it can discover the fundamental laws of the human mind, by contemplating it in itself, without paying any attention either to the causes or the effects of its activity.

50. The preponderance of the Positive Philosophy has been steadily growing since Bacon's time. It has to-day acquired, indirectly, so great a hold over even those minds which are the least familiar with its immense development that the metaphysicians devoted to the study of the intellect could only hope to check the decadence of their pretended science, by presenting their doctrines as being also founded upon the observation of facts. In order to do this, they have recently attempted to distinguish, by a very singular subtlety, two kinds of observation of equal importance, the one exterior, the other interior, the last being solely devoted to the study of intellectual phenomena. To enter into a special discussion of this fundamental sophism would be out of place here. I must be content with indicating the principal consideration which proves, clearly, that this pretended direct contemplation of the mind by itself is a pure illusion.

51. It was thought, until quite recently, that vision was explained by saying that

the luminous action of bodies produces on the retina actual pictures, representing exterior forms and colours. To this the physiologists have reasonably objected that, if the luminous impressions produced real paintings on the retina, we should need another eye to see them. Is not this reasoning still more applicable in the present instance?

52. It is clear that, by an inevitable necessity, the human mind can observe all phenomena directly, except its own. For by whom would the observation be made? As far as moral phenomena are concerned, it may be granted that it is possible for a man to observe the passions which animate him, for the anatomical reason that the organs which are their seat are distinct from those whose functions are devoted to observation. Everyone has had occasion to notice this fact for himself, but such observations would evidently never possess much scientific value. The best way of knowing the passions will always be to observe them from the outside; for a person in any state of extreme passion—that is to say, in precisely the state which it is most essential to examine—would necessarily be incapacitated for observing himself. But in the case of intellectual phenomena, to observe them in this manner while they are taking place is clearly out of the question. The thinking individual cannot cut himself in two—one of the parts reasoning, while the other is looking on. Since in this case the organ observed and the observing organ are identical, how could any observation be made?

53. The principle of this so-called psychological method is therefore quite worthless. Besides, consider to what thoroughly contradictory proceedings it immediately leads! On the one hand,

you are recommended to isolate yourself, as far as possible, from the outer world, and you must especially give up all intellectual work; for if you were only engaged in making the simplest calculation, what would become of the *interior* observation? On the other hand, after having, by means of due precautions, at last attained to this perfect state of intellectual slumber, you must then occupy yourself in contemplating the operations which will be taking place in a mind supposed to be blank! Our descendants will no doubt see such pretensions ridiculed on the stage some day.

54. The results of such a strange procedure are in thorough accordance with the principle. For the last two thousand years the metaphysicians have in this manner been cultivating psychology, and yet they have not been able to agree on one single intelligible and sound proposition. They are, even at the present day, divided into a multitude of schools which are incessantly disputing on the first elements of their doctrines. In fact, *interior observation* gives rise to almost as many divergent opinions as there are so-called observers.

55. The true scientists—the men devoted to the positive sciences—are still calling in vain on these psychologists to cite a single real discovery, great or small, due to this much-vaunted method. It does not follow that all their labours have been absolutely fruitless as regards the general progress of our knowledge, and we must remember the valuable service which they rendered in sustaining the activity of human intelligence, at a time when it could find no more substantial aliment. But their writings largely consist of what an illustrious positive philosopher, M. Cuvier, has well

called "metaphors mistaken for reasoning." We may safely affirm that any true notions they present have been obtained, not by their pretended method, but by those actual observations on the progress of the human mind to which the development of the sciences has from time to time given birth. And even these ideas, so scanty in number, although proclaimed with so much emphasis, and only due to the unfaithfulness of the psychologists to their pretended method, are generally either greatly exaggerated or very incomplete, and they are very inferior to the remarks which scientists have already unostentatiously made upon the methods which they employ. It would be easy to cite some striking examples of this, if I did not fear that I should be prolonging the discussion of the point too much: take, for instance, the treatment of the theory of algebraical signs by metaphysicians and geometers respectively.

56. The considerations relating to logical science which I have just indicated become still more evident when we deal with the art of logic.

57. For when we want not only to know what the Positive Method consists in, but also to have such a clear and deep knowledge of it as to be able to use it effectively, we must consider it in action; we must study the various great applications of the method which the human mind has made and already verified. In a word, it is only by a philosophical examination of the sciences that we can attain the desired result. The method does not admit of being studied apart from the researches on which it is employed; or, at all events, it is only a lifeless study, incapable of fertilising the mind which resorts to it. Looking at it in that abstract way, the only real information that you can give

about it amounts to no more than a few general propositions, so vague that they can have no influence on mental habits. When we have thoroughly established, as a logical thesis, that all our knowledge must be founded upon observation, that we must proceed sometimes from facts to principles, at other times from principles to facts, and some other similar aphorisms, we still know the method far less clearly than he who has studied at all completely a single positive science, even without any philosophical purpose in view. It is because they have failed to recognise this essential fact that our psychologists have been led to take their reveries for science, in the belief that they understood the Positive Method because they have read the precepts of Bacon or the discourse of Descartes.

58. I do not know if, in the future, it will become possible to construct by *a priori* reasoning a genuine course on Method, wholly independent of the philosophical study of the sciences; but I am quite convinced that it cannot be done at present, for the great logical methods cannot yet be explained with sufficient precision apart from their applications. I venture to add, moreover, that, even if such an enterprise could be eventually carried out, which is conceivable, it would nevertheless only be through the study of regular applications of scientific methods that we could succeed in forming a good system of intellectual habits; which is, however, the essential object to be gained by studying method. There is no need to insist further just now on a subject which will frequently recur throughout this work, and in regard to which I shall present some new considerations in the next chapter.

59. The first great direct result of the



Positive Philosophy is, then, the manifestation by experience of the laws which our intellectual functions follow in their operations; and, consequently, a precise knowledge of the general rules which are suitable for our guidance in the investigation of truth.

60. A second consequence of no less importance and of much more urgent concern, which must immediately result from the establishment of the Positive Philosophy as defined in this chapter, is the recasting of our educational system.

61. Competent judges are already unanimous in recognising the necessity of replacing our European education, which is still essentially theological, metaphysical, and literary, by a *positive* education in accordance with the spirit of our time and adapted to the needs of modern civilisation. Various attempts have been made in increasing number during the last hundred years, and especially during recent years, to spread and augment, without ceasing, instruction of a positive kind. Such attempts, which the different European Governments have always eagerly encouraged and often initiated, are a sufficient testimony that the spontaneous feeling of this necessity is everywhere growing. But, while supporting these useful enterprises as much as possible, we must not conceal the fact that, in the present state of our ideas, they are not at all capable of attaining their principal object—namely, the fundamental regeneration of general education. The exclusive speciality, the too rigid isolation, which still characterises our way of conceiving and of cultivating the sciences has necessarily a marked influence upon the mode of teaching them. An intelligent person who wishes at the present day to study the principal branches of Natural Philo-

sophy, in order to acquire a general system of positive ideas, is obliged to study each separate science in the same way, and with the same amount of detail, as if he wished to become an astronomical or chemical specialist, etc. This renders such an education almost impossible and necessarily very imperfect, even in the case of the most intelligent minds, placed in the most favourable circumstances. Such a mode of proceeding would, therefore, be wholly chimerical as regards general education; and yet an essential requirement of the latter is a complete body of positive conceptions on all the great classes of natural phenomena. It is such a general survey, on a more or less extended scale, which must henceforth constitute, even among the mass of the people, the permanent basis of all human combinations; it must, in short, constitute the mental framework of our descendants. In order that Natural Philosophy may be able to complete the already partially accomplished regeneration of our intellectual system, it is, therefore, indispensable that the different sciences of which it is composed—regarding them as the different branches of a single trunk—should be first reduced to what constitutes their essence—that is, to their principal methods and most important results. It is only in this way that the teaching of the sciences can become the basis of a new general and really rational education for our people. Of course, each individual, after receiving this general education, will have to supplement it by such special education as he may require, in which he will study one or other of the special sciences. But the essential consideration which I wished to point out here is that all these special studies, even if by great labour

all of them were mastered, would be necessarily insufficient to really renew our educational system, if they did not rest on the preliminary basis of this general education, itself the direct result of the Positive Philosophy as defined in this discourse.

62. The special study of scientific generalities is not only destined to re-organise education, but it will also contribute to the particular progress of the different Positive Sciences. This constitutes the third fundamental property which I have to point out.

63. The divisions which we establish between the sciences, although not arbitrary, as some people suppose, are yet essentially artificial. In reality, the subject of all our researches is one; we only divide it so that we may, by separating the difficulties, resolve them more easily. And so it occasionally happens that these established divisions are a hindrance, and that questions arise which need to be treated by combining the points of view of several sciences. This cannot be easily done when scientists are so addicted to specialism. Hence the problems are left unsolved for a much longer time than would otherwise be necessary. Such an inconvenience must make itself especially felt in the case of the more essential doctrines of each positive science. Very striking examples of this fact could be easily cited, and I shall carefully call attention to them as they occur in the course of this work.

64. I could cite a very memorable example of this in the past, in the case of the admirable conception of Descartes relating to analytical geometry. This fundamental discovery, which has changed the aspect of mathematical science, and in which we should see the true germ of all the great subsequent

progress, is simply the result of establishing a closer connection between two sciences which had hitherto been regarded from separate standpoints. But the case will be still more decisive if we consider some questions which are still under discussion.

65. I will take the case, in Chemistry, of the important doctrine of Definite Proportions. It is certain that the memorable discussion which has been raised in our own time, relating to the fundamental principle of this theory, cannot yet be considered, in spite of appearances, as irrevocably terminated. For this is not, in my opinion, a simple question of chemistry. I venture to assert that, in order to settle the point definitively—that is, to determine whether it is a law of nature that atoms necessarily combine together in fixed proportions—it will be indispensable to unite the chemical with the physiological point of view. This is shown by the fact that, even in the opinion of the illustrious chemists who have most powerfully contributed to the formation of this doctrine, the utmost that can be said is that it is always verified in the composition of inorganic bodies; but it is no less constantly at fault in the case of organic compounds, to which up to the present it seems quite impossible to extend the doctrine. Now, before erecting the theory into a truly fundamental principle, ought not this immense exception to be first considered? Does it not belong to the same general characteristic of all organic bodies, that in none of their phenomena can we make use of invariable numbers? However that may be, an entirely new order of considerations, belonging equally to chemistry and physiology, is evidently necessary in order to decide finally, in some way or

other, this great question of natural philosophy.

66. I think it will be well to consider here a second example of the same kind, which, since it relates to a subject of much more limited scope, shows even more conclusively the special importance of the Positive Philosophy in the solution of questions which need the combination of several sciences. This example, which I also take from Chemistry, is the still controverted question as to whether, in the present state of our knowledge, nitrogen should be regarded as an element or a compound. The illustrious Berzelius, differing from almost all living chemists, believes it to be a compound; and the reasons, of a purely chemical nature, which he gives for his opinion are so weighty as to balance those of his opponents. But what I want particularly to point out is that Berzelius, as he admits himself—and a most instructive admission it is—was greatly influenced by the physiological observation that animals which feed on non-nitrogenous matter contain in their tissues just as much nitrogen as the carnivorous animals. It is therefore quite clear that, in order to decide whether nitrogen is or is not an element, we must necessarily call in the aid of physiology, and combine with chemical considerations, properly so-called, a series of new researches on the relation between the composition of living bodies and the nature of their food.

67. It would be superfluous now to go on multiplying examples of these complex problems, which can only be solved by the intimate combination of several sciences which are at present cultivated in a wholly independent manner. Those which I have just cited are sufficient to show, in a general way, the importance of

the function which the Positive Philosophy will perform in perfecting each of the natural sciences, since it is directly destined to organise in a permanent manner combinations of this kind, which could not be suitably formed without its aid.

68. There is a fourth and last fundamental property of what I have called the Positive Philosophy, to which I must thus early draw attention, and which no doubt deserves our notice more than any other property, since it is to-day the most important one from a practical point of view. We may look upon the Positive Philosophy as constituting the only solid basis of the social reorganisation, which must terminate the crisis in which the most civilised nations have for so long found themselves. The last part of this course will be specially devoted to establish and develop this proposition. But the general sketch of my great subject which I have undertaken to give in this chapter would lack one of its most characteristic elements if I failed to call attention here to such an essential consideration.

69. It may be thought that I am making a too ambitious claim for the Positive Philosophy. But a few very simple reflections will suffice to justify it.

70. There is no need to prove to readers of this work that the world is governed and overturned by ideas, or, in other words, that the whole social mechanism rests finally on opinions. They know, above all, that the great political and moral crisis of existing societies is due at bottom to intellectual anarchy. Our gravest evil consists, indeed, in this profound divergence which now exists among all minds, with regard to all the fundamental maxims whose fixity is the first condition of a true

social order. As long as individual minds are not unanimously agreed upon a certain number of general ideas capable of forming a common social doctrine, we cannot disguise the fact that the nations will necessarily remain in an essentially revolutionary state, in spite of all the political palliatives which may be adopted. Such a condition of things only really admits of provisional institutions. It is equally certain that, if this general agreement upon first principles can be once obtained, the appropriate institutions will necessarily follow, without giving rise to any grave shock; for the greater part of the disorder will have been already dissipated by the mere fact of the agreement. All those, therefore, who feel the importance of a truly normal state of things should direct their attention mainly to this point.

71. And now, from the lofty standpoint to which the various considerations indicated in this chapter have step by step raised us, it is easy both to characterise clearly the present state of society as regards its inner spirit, and to deduce therefrom the means by which that state can be essentially changed. Returning to the fundamental law enunciated at the commencement of this chapter, I think we may sum up exactly all the observations relating to the existing situation of society, by the simple statement that the actual confusion of men's minds is at bottom due to the simultaneous employment of three radically incompatible philosophies—the Theological, Metaphysical, and Positive. It is quite clear that, if any one of these three philosophies really obtained a complete and universal preponderance, a fixed social order would result, whereas the existing evil consists above all in the absence of any true organisation. It is

the existence of these three opposite philosophies which absolutely prevents all agreement on any essential point. Now, if this opinion be correct, all that is necessary is to know which of the three philosophies can and must prevail by the nature of things; every sensible man should next endeavour to work for the triumph of that philosophy, whatever his particular opinions may have been before the question was analysed. The question being once reduced to these simple terms, the issue cannot long remain doubtful, because it is evident for all kinds of reasons, some of the principal of which have been indicated in this chapter, that the Positive Philosophy is alone destined to prevail in the ordinary course of things. It alone has been for many centuries making constant progress, while its antagonists have been as constantly in a state of decay. Whether this is a good or a bad thing matters little; the general fact cannot be denied, and that is sufficient. We may deplore the fact, but we are unable to destroy it; nor, consequently, can we neglect it, on pain of giving ourselves up to illusory speculations. This general revolution of the human mind is, at the present time, almost entirely accomplished. Nothing more remains to be done, as I have already explained, than to complete the Positive Philosophy by including in it the study of Social Phenomena, and then to sum them up in a single body of homogeneous doctrine. When these two tasks have made sufficient progress, the final triumph of the Positive Philosophy will take place spontaneously, and will re-establish order in society. The marked preference which almost all minds, from the highest to the lowest, show, at the present day, for positive knowledge, as contrasted with

vague and mystical conceptions, augurs well for the reception which awaits this Philosophy when it shall have acquired the only quality which it still lacks—a character of suitable generality.

72. To sum the matter up: the Theological and Metaphysical philosophies are now disputing with each other the task of reorganising society, although the task is really too hard for their united efforts; it is between these schools only that any struggle still exists in this respect. The Positive Philosophy has, up to the present, only intervened in the contest in order to criticise both schools; and it has accomplished this task so well as to entirely discredit them. Let us now put it in a condition to play an active part, without paying any further attention to debates which have become useless. We must complete the vast intellectual operation commenced by Bacon, Descartes, and Galileo, by furnishing the Positive Philosophy with the system of general ideas which is destined to prevail henceforth, and for an indefinite future, among the human race. The revolutionary crisis which harasses civilised peoples will then be at an end.

73. Such are the four principal advantages which will follow from the establishment of the Positive Philosophy. I have thought it well to mention them at once, because they supplement the general definition which I have tried to give of it.

74. Before concluding, I desire to caution the reader briefly against an erroneous anticipation which he might form as to the nature of the present work.

75. In saying that the aim of the Positive Philosophy was to sum up, in a single body of homogeneous doctrine, the aggregate of acquired knowledge relating to the different orders of natural phenomena, I did not mean that we should proceed to the general study of

these phenomena, by looking upon them all as so many different effects of a single principle, as reducible to one sole law. Although I must treat this question specially in the next chapter, I think it necessary to say so much at once, in order to avoid unfounded objections which might otherwise be raised. I refer to those critics who might jump to the conclusion, that this course is one of those attempts at universal explanation by a single law, which one sees daily made by men who are entire strangers to scientific methods and knowledge. Nothing of that kind is intended here; and the development of this course will furnish the best proof of it, to all those whom the explanations contained in this chapter might have left in any doubt on the subject.

76. It is my deep personal conviction that these attempts at the universal explanation of all phenomena by a single law are highly chimerical, even when they are made by the most competent minds. I believe that the resources of the human mind are too feeble, and that the universe is too complicated, to admit of our ever attaining such scientific perfection; and I also think that a very exaggerated idea is generally formed of the advantages to be derived from it, even were it attainable. In any case, it seems to me evident that, considering the present state of our knowledge, we are yet a long way off from the time when any such attempt might be reasonably expected to succeed. It seems to me that we could only hope to arrive at it, by connecting all natural phenomena with the most general positive law we are acquainted with—the Law of Gravitation—which already links all astronomical phenomena to some of the phenomena of terrestrial physics. Laplace has

actually brought forward a conception by which chemical phenomena would be regarded as purely simple molecular effects of Newtonian attraction, modified by the figure and mutual position of the atoms. This conception would probably always remain an open question, owing to the absence of any essential data respecting the intimate constitution of bodies; and it is almost certain that the difficulty of applying the idea would be so great that we should still be obliged to retain, as an artificial aid, the division which is at present regarded as natural between astronomy and chemistry. Accordingly, Laplace only presented this idea as a mere philosophical pastime, which was incapable of really exercising any useful influence on the progress of chemical science. The case is, however, really still stronger, for even if we supposed this insurmountable difficulty overcome, we should still not have attained scientific unity, since it would be necessary next to connect the same law of gravitation with the whole of physiology; and this would certainly not be the least difficult part of the task. And, yet, the hypothesis which we have just been discussing would be, on the whole, the most favourable to this much-desired unity.

77. I have no need to go further into details in order to convince the reader that the object of this course is by no means to present all natural phenomena as being at bottom identical, apart from the variety of circumstances. The Positive Philosophy would no doubt be more perfect if this were possible. But this condition is not at all necessary, either for its systematic formation or for the realisation of the great and happy consequences which we have seen that it is destined to produce. The only indispensable unity for those purposes is that

of Method, which can and evidently must exist, and is already largely established. As to the Doctrine, it is not necessary that it should be *unified*; it is sufficient if it be *homogeneous*. It is, therefore, from the double standpoint of unity of method and homogeneity of doctrines that the different classes of positive theories will be considered in the present work. While trying to diminish, as far as possible, the number of general laws necessary for the positive explanation of natural phenomena—which is the real philosophic purpose of all science—we shall think it rash ever to hope, even in the most distant future, to reduce these laws rigorously to a single one.

78. I have attempted in this chapter to determine, as exactly as I could, the aim, the spirit, and the influence of the Positive Philosophy. I have, therefore, indicated the goal towards which my labours have always tended, and always will tend unceasingly, in this course or elsewhere. No one is more profoundly convinced than myself of the inadequacy of my intellectual powers, even if they were far superior to what they are, to undertake such a vast and noble work. But although the task is too great for a single mind or a single lifetime, yet one man can state the problem clearly, and that is all I am ambitious of doing.

79. Having thus expounded the true aim of this course, by settling the point of view from which I shall consider the various principal branches of Natural Philosophy, I shall in the next chapter complete these general preliminaries by explaining the plan I have adopted—that is to say, by determining the encyclopædic order which should be established among the several classes of natural phenomena, and consequently among the corresponding Positive Sciences.

## PART II.

### EXPLANATION OF THE PLAN OF THIS COURSE, OR GENERAL CONSIDERATIONS ON THE CLASSIFICATION OF THE POSITIVE SCIENCES

1. THE considerations to be presented in this course on all the principal branches of Natural Philosophy have been characterised as exactly as possible in the preceding chapter. We must now determine the plan which we should follow, by finding what is the most suitable rational Classification of the different fundamental Positive Sciences, so that we may study them in succession from the standpoint which we have adopted. This second general discussion is indispensable, in order to make clear at the outset the true spirit of this course.

2. We can easily see, in the first place, that there is no need to criticise here the numerous Classifications which have been successively proposed during the last two centuries as general systems of human knowledge, regarded in its entirety. We are at the present time thoroughly convinced that all the encyclopædic scales—such as those of Bacon and D'Alembert—which are based upon any distinction between the different faculties of the human mind, are for that reason alone radically defective. That is true even when this distinction is not, as is often the case, more subtle than real; for in each of its spheres of activity our understanding makes simultaneous use of all its principal faculties. As to all the other Classifications which have been proposed,

it is sufficient to observe that the definite result of the different discussions raised upon this subject has been to demonstrate in each of them some radical defect or other; so that not one of them has been able to command universal assent, there being in this respect almost as many opinions as there are individuals holding them. These different attempts have, indeed, been as a rule so badly conceived that a prejudice has involuntarily arisen in most intelligent minds against every undertaking of this kind.

3. Without dwelling further on such a well-established fact, it is more essential to seek the cause of it. We can easily account for the profound imperfection of those attempts at classification which have been so often renewed up to the present time. I need hardly say that, owing to the general discredit into which works of this nature have fallen, due to the inadequacy of the earlier schemes, these Classifications are now seldom attempted, except by persons almost entirely ignorant of the sciences which they undertake to classify. But, putting this personal consideration on one side, there is a much more important one, drawn from the very nature of the subject, which shows clearly why it has not hitherto been possible to rise to an encyclopædic conception of a really

satisfactory character. It consists in the want of homogeneity which has always existed until recently between the different parts of the intellectual system, some having successively become Positive, while others remained Theological or Metaphysical. In such an incoherent condition of things, it was evidently impossible to establish any rational Classification. How could one succeed in arranging in a single system conceptions so profoundly contradictory? It is a difficulty which necessarily proved a stumbling-block to all the classifiers, and none of them were able to perceive its nature distinctly. It was very evident, however, for anyone who had grasped the true state of the human mind, that such an enterprise was premature, and could not be successfully attempted until all our principal ideas had become Positive.

4. The explanations given in the preceding chapter show that this fundamental condition can now be regarded as fulfilled; it is therefore possible to form a truly rational and stable arrangement of a system whose parts have at last become homogeneous.

5. On the other hand, the general Theory of Classification which the philosophical labours of botanists and zoologists have established in modern times encourages us to hope for real success in such a task, since it offers us a sure guide in the true fundamental principle of the art of classifying, which had never been clearly conceived until then. This principle is a necessary consequence of the only direct application of the Positive Method to this question of Classification, which, like every other question, should be treated as a matter of observation, instead of being determined by *a priori* considerations. The

principle is this—the Classification must proceed from a direct study of the objects to be classified, and must be determined by the real affinities and natural connections which they present. In this way, the Classification will itself become the expression of the most general fact which is manifested by a profound comparison of the objects embraced by it.

6. Applying this fundamental rule to the present case, it follows that the mutual dependence which actually exists between the different Positive Sciences must determine our Classification of them; and this dependence, if it is to be real, can only result from that of the corresponding phenomena.

7. But, before proceeding in this observational spirit to the important work of Classification, it is indispensable, if we are not to lose our way in a work of too great compass, that we should circumscribe more precisely than we have yet done the subject that we propose to classify.

8. All human works deal either with Speculation or Action, and the most general division, therefore, of our knowledge is into Theoretical and Practical. If, in the first place, we consider this primary division, it is clear that we need only concern ourselves with Theoretical knowledge in a course of this kind. It is not a question of dealing with the entire system of human ideas, but only with those fundamental conceptions of the different orders of phenomena, which furnish a solid basis to all our other mental combinations of whatever kind, while being themselves independent of any antecedent intellectual system. Now, in such a study, it is theory which we have to consider, and not the application of it—except in so far as the



application may elucidate the theory. This is probably what Bacon understood, although very imperfectly, by that First Philosophy which he said should be extracted from the whole of the sciences, and which has been so differently, and always so strangely, conceived by the metaphysicians who have undertaken to explain his idea.

9. No doubt, when we embrace in our view human labour as a whole, whether Theoretical or Practical, we must regard our study of nature as intended to furnish us with the true rational basis for acting upon Nature. For it is only by knowing the laws of phenomena, and so foreseeing their occurrence, that we are able in active life to make these phenomena modify one another for our advantage. Our direct natural power of acting upon our environment is extremely feeble, and wholly disproportioned to our needs. Whenever we succeed in accomplishing anything great, it is due to the fact that our knowledge of natural laws allows us to introduce, among the fixed conditions under whose influence the different phenomena take place, some modifying elements. These, however feeble they may be in themselves, are in certain cases sufficient to turn to our advantage the final results of the sum-total of external causes. We may sum up very exactly the general relation of Science to Art, using these two words in their widest sense, by the following very simple formula: from Science comes Prevision; from Prevision comes Action.

10. But in spite of the vital importance of this relation, which must never be ignored, we should form a very imperfect idea of the Sciences if we were to regard them only as the bases of the Arts, an error to which our Age is, unhappily, too much inclined. Immense as are the

services rendered to Industry by Science, and although according to the striking aphorism of Bacon—Knowledge is Power—we must never forget that the sciences have a yet higher and more direct destination, that of satisfying the craving of our minds to know the laws of phenomena. To feel how deep and urgent this craving is, it is sufficient to reflect for a moment upon the physiological effects of *astonishment*, and to recollect that the most terrible sensation which we can experience is that which occurs, whenever any phenomenon appears to take place in violation of the natural laws which are familiar to us. This need of arranging facts in an easily comprehended order—which is the proper object of all scientific theories—is so inherent in our organisation that, if we could not succeed in satisfying it by Positive conceptions, we should have to return inevitably to those Theological and Metaphysical explanations which, as I explained in the last chapter, had their origin in this need.

11. I have thought it well to point out expressly at this stage a consideration which will frequently recur in the course of this work, in order to indicate the necessity of guarding against the undue influence of the habits of the present day, which tend to prevent the formation of just and noble ideas on the importance and destination of the Sciences. The general tendency of our time is, in this respect, defective and narrow. But, in the case of scientists, it is corrected, consciously or not, by the strong natural craving of which I have spoken. Otherwise the human intellect would be confined to researches of immediate practical utility, and, as Condorcet very justly remarked, would for that reason alone be completely arrested in its progress. This

would be the case even as regards those practical applications to which we should have imprudently sacrificed the purely theoretical labours; for the most important practical applications are constantly derived from theories formed for purely scientific purposes, and which have often been cultivated during many centuries without producing any practical result. A very remarkable example of this can be cited in the beautiful speculations of the Greek geometers on Conic Sections. These, after a long series of generations, effected the renovation of astronomy, and so finally enabled the art of navigation to reach that degree of perfection to which it has in modern times attained, and which would never have been reached without the aid of such purely theoretical labours as those of Archimedes and Apollonius. As Condorcet truly said: "The sailor who is preserved from shipwreck by an exact observation of the longitude owes his life to a theory conceived two thousand years before, by some men of genius who had in view simply geometrical speculations."

12. It is, therefore, evident that, after the study of Nature has been conceived in a general way as serving for the rational basis of our action upon it, we must next proceed to theoretical researches, leaving wholly on one side every practical consideration. Our means for discovering truth are so feeble that if we do not concentrate them exclusively upon this object, and if we hamper our search for truth with the extraneous condition that it shall have some immediate practical utility, it would be almost always impossible for us to succeed.

13. However that may be, it is certain that the aggregate of our knowledge about Nature, and the aggregate of prac-

tical procedures which we deduce from that knowledge in order to modify the natural order for our advantage, form two essentially distinct systems, which it is convenient to conceive of and to cultivate separately. Besides, the first system being the base of the second, it is clearly the one which should be considered first in a methodical course of study, even if it were proposed to embrace therein the whole of Human Knowledge, both Theoretical and Practical. It appears to me that this Theoretical system should be the only subject dealt with at the present day in a truly rational course of Positive Philosophy; at least, that is the way in which I regard the matter. No doubt it would be possible to imagine a more extended course, dealing with the generalities of both Theory and Practice. But I do not think that such an enterprise, even apart from its vast extent, could be suitably attempted in the present condition of the human mind. It seems to me, indeed, to demand previous work of a very important and wholly special nature, which has not yet been accomplished—that of constructing, in accordance with scientific theories proper, the special conceptions intended to serve as direct bases for the general operations of Practice.

14. In the present condition of mental development, the Sciences are not directly applicable to the Arts, at least in the most perfect cases. Between these two orders of ideas there lies a third, which, although still ill-determined in its philosophical character, is yet very apparent when we consider the class of persons who are specially occupied with it. Between the scientists proper and the actual directors of industry an intermediate class is rising up—that of the engineers, whose particular function is to

settle the relations between Theory and Practice. Unconcerned with the progress of scientific knowledge, they study it in its present state for the purpose of deducing from it the industrial applications which it can furnish. Such, at least, is the natural tendency of things, although there is still much confusion in this respect. The body of knowledge which should form the equipment of the engineering class, and which should establish the true direct theories of the different Arts, might no doubt give rise to philosophical considerations of great interest and real importance. But a work which should embrace them together with the theories founded on the pure Sciences would at present be altogether premature; because these doctrines, intermediate between pure theory and direct practice, are not yet formed. Such imperfect elements of them as at present exist relate to the more advanced Sciences and Arts, and these merely allow us to conceive the nature and possibility of similar labours dealing with the whole body of human operations. It is thus—to cite the most important example—that we must regard the fine conception of Monge, relating to Descriptive Geometry, which is really nothing else than a general theory of the arts of construction. Very few similar ideas have as yet been formed in other departments; I shall take care to notice them at their proper places in this course, and to point out their importance. But it is clear that conceptions which, up to the present, are so incomplete, should not enter as an essential part into a course of Positive Philosophy, which should, as far as possible, be confined to such doctrines as have a fixed and clearly determined character.

15. How difficult it is to construct these intermediate doctrines will be the better realised if we consider that every Art depends not only upon a certain corresponding Science, but upon several sciences simultaneously, so that the most important Arts borrow direct help from almost all the different principal Sciences. For example, the true theory of Agriculture—to confine myself to the principal case—demands an intimate combination of physiological, chemical, physical, and even astronomical and mathematical knowledge. The same thing is true in the case of the fine arts. Bearing this fact in mind, we easily perceive why these theories could not yet have been formed, since they assume the previous development of all the different fundamental Sciences. Here, then, is another reason for not including such an order of ideas in a course of Positive Philosophy, since, far from being able to contribute to the systematic formation of this Philosophy, the general theories peculiar to the different principal Arts must, on the contrary, be a future consequence, and one of the most useful consequences, of its construction.

16. In this course, then, we must consider only scientific theories, and not their practical applications. But a further distinction has still to be drawn with respect to the theories themselves. When this has been done, the field of our inquiry will at last be duly limited, and we shall be able to proceed to a methodical Classification of the Sciences with which Positive Philosophy is concerned.

17. We must distinguish, with reference to all kinds of phenomena, two classes of natural science. The first consists of the Abstract or General Sciences, whose object is the discovery of the laws

regulating the different classes of phenomena in all conceivable cases. The other group comprises the Concrete, Special, or Descriptive Sciences, sometimes called the Natural Sciences proper, whose function consists in applying these laws to the actual history of the different existing beings. The Abstract Sciences are, therefore, fundamental ones, and our studies in this course are concerned with them alone; the others, whatever may be their intrinsic importance, are really only secondary sciences, and, consequently, should not form part of a work whose great natural extent compels us to reduce it to the least possible development.

18. The distinction just drawn cannot present any difficulty to those who are at all familiar with the different Positive Sciences, since it is almost equivalent to the distinction which is usually made in nearly all scientific works between Dogmatic Physics and Natural History properly so-called. The importance of this division of the sciences into two groups is not yet sufficiently appreciated, and some examples will serve to render its nature more evident.

19. The distinction may, in the first place, be perceived very clearly by comparing, on the one hand, general Physiology, and, on the other, Zoology and Bôtany. Studying the laws of life in general, and determining the mode of existence of each living being as an individual, are evidently two works of very different character. The second study is besides necessarily founded on the first.

20. The same thing is true in the case of Chemistry as contrasted with Mineralogy; the first science is evidently the rational basis of the second one. In Chemistry we consider every possible

molecular combination in every imaginable circumstance; in Mineralogy we consider only those combinations which are actually found to occur as constituents of the Earth, and as subject to terrestrial influences alone. The difference between the chemical and mineralogical standpoint, although both sciences deal with the same objects, is clearly shown by the circumstance that the majority of the facts considered in chemistry have only an artificial existence; so that a body such as chlorine or potassium may possess great chemical importance owing to the extent and energy of its affinities, while its mineralogical interest may be almost nil. On the other hand, although a mineralogist would have a great deal to say about a compound such as granite or quartz, such a substance would be of little interest from a chemical standpoint.

21. What makes still more evident the logical necessity of this fundamental distinction between the two great sections of Natural Philosophy is the fact that not only does each section of Concrete Physics presuppose the previous study of the corresponding section of Abstract Physics, but that it also demands a knowledge of the general laws relative to all orders of phenomena. Thus, for example, the special study of the earth considered under every possible aspect not only demands a previous acquaintance with physics and chemistry, but it cannot be properly accomplished without introducing, on the one hand, astronomical, and, on the other hand, physiological, knowledge; so that Geology is related to the entire system of fundamental sciences. The same thing is true of each of the other Concrete Sciences. It is precisely for this reason that Concrete Physics has up to the

present made so little real progress, because its study could not be begun in a truly rational manner until all the different principal branches of Abstract Physics had acquired a definite character, which did not occur until our own time. Until that had taken place, it was only possible to collect upon this subject some more or less unco-ordinated materials, which are still very incomplete. The known facts cannot be co-ordinated in such a way as to form true special theories of the different beings of the universe, until the fundamental distinction between the Abstract and Concrete sciences is more profoundly felt and more regularly organised, and until the scientists who are specially devoted to the study of the Concrete Sciences recognise the necessity of founding their researches upon a thorough knowledge of all the fundamental Abstract Sciences. The latter is a condition which is still very far from being properly fulfilled at the present day.

22. Examining this condition, we find a confirmatory reason why, in this course of Positive Philosophy, we should confine ourselves to considering the Abstract or General sciences, and not include at the same time the Descriptive or Special sciences. We discover that a new essential property of the study of the generalities of Abstract Physics is to furnish the rational basis of a truly systematic Concrete Physics. In the present condition of human intelligence there would, therefore, be a species of contradiction in wishing to unite the two orders of science in a single course. We can say, moreover, that, even if Concrete Physics had already attained the same degree of perfection as Abstract Physics, so that it would consequently be possible to embrace both at the same time in a

course of Positive Philosophy, it would be evidently none the less necessary to commence with the Abstract section, for that would remain the invariable base of the other. It is clear, besides, that the study of the generalities alone of the fundamental sciences is so extensive by itself that it is important to set aside as much as possible all considerations which are not indispensable; now, those relating to the secondary sciences will always be in any case of a distinct order. Since the philosophy of the fundamental sciences presents a system of positive conceptions upon all the categories of real knowledge, it is for that reason alone sufficient to constitute that First Philosophy which Bacon sought for; and, since it is destined henceforth to serve as the permanent basis for all human speculations, it should be carefully reduced to the simplest possible expression.

23. I need not pursue this argument further at present, as I shall have several opportunities of recurring to it in the different parts of this course. I have said enough to explain how and why I limit our inquiry.

24. It follows, then, from the considerations that have been set forth in this chapter: (1) That Human Knowledge as a whole being composed of Theoretical and of Practical knowledge, we are concerned here only with the former; (2) that Theoretical knowledge, or Science properly so-called, being divided into General and Special Sciences, we have only to consider here the first kind, and, interesting as Concrete Physics may be, it is to Abstract Physics that we must confine ourselves.

25. The proper subject of this course having thus been exactly limited, it is now easy to proceed to a really satisfactory rational Classification of the

Fundamental Sciences, which is the encyclopædic question forming the special subject of this chapter.

26. We must, in the first place, recognise that, however natural such a Classification may be, it necessarily always involves something, if not arbitrary, at least artificial. It will, therefore, never be absolutely perfect.

27. The principal object to be kept in view in every attempt at Classification is the arrangement of the sciences in the order of their natural connection, according to their mutual dependence, so that one might be able to present them successively, without ever being in the smallest degree involved in a vicious circle. Now, that is a condition which seems to me impossible to fulfil quite rigorously. Perhaps I may be allowed here to develop this reflection at some length; it is in my opinion an important one, for herein lies the real difficulty of the present inquiry. Besides, its treatment will give me an opportunity of establishing, in connection with the exposition of our knowledge, a general principle which I shall have to apply frequently later on.

28. It is this. Every science can be expounded according to two essentially distinct methods—the Historical and the Dogmatic; every other mode of exposition is only a combination of these methods.

29. By the first method, the knowledge is presented in the same order as that in which the human mind actually obtained it, following as far as possible the actual track pursued.

30. By the second method, the system of ideas is presented as it might be conceived of to-day by a single mind which, being placed at the right point of view and furnished with sufficient knowledge,

should apply itself to the reconstruction of the science as a whole.

31. The first mode is evidently that by which the study of every new science must of necessity commence, because it presents the feature of not requiring for the exposition of the knowledge any new independent work. The didactic art reduces itself in that case to the studying in chronological order of the different original works which have contributed to the progress of the science.

32. The Dogmatic Method supposes, on the contrary, that all these individual works have been recast into a general system, so that they may be presented in a more natural logical order; it is, therefore, only applicable to a science which has already arrived at a sufficiently high degree of development. But in proportion as the science progresses, the *historical* order of exposition becomes more and more impracticable, owing to the lengthy series of intermediate works which the mind would be compelled to travel over; whereas the *dogmatic* order becomes more and more possible, and at the same time necessary, because new conceptions permit the earlier discoveries to be presented under a more direct point of view.

33. The education of an ancient geometer, for example, consisted simply in studying, in due order, the very small number of original treatises on the different parts of Geometry which then existed; and this amounted to little more than the writings of Archimedes and Apollonius. On the other hand, a modern geometer has usually finished his education without having read a single original work, except in the case of the most recent discoveries which can only be known by this means.

34. The constant tendency of the

human mind in the exposition of its knowledge is, therefore, to substitute more and more the Dogmatic for the Historical Method, the former alone being suited to the mature state of our intelligence.

35. The general problem of intellectual education consists in enabling an individual of usually but average ability to reach in a few years the same stage of development which has been attained during a long series of ages by the efforts of a large number of superior thinkers, who have throughout their lives concentrated their attention upon the same subject. It is accordingly clear that, although it is infinitely easier and quicker to learn than to originate, it would be quite impossible to attain the desired end if we tried to compel each individual mind to pass successively through the same intermediate stages which the collective genius of mankind has necessarily had to traverse. Hence the indispensable need for the Dogmatic Method, as is especially evident at the present day in the most advanced Sciences, the ordinary teaching of which shows hardly any trace of the actual steps of their evolution.

36. We must, however, add, in order to avoid any exaggeration, that every actual mode of teaching in use is necessarily a certain combination of the Dogmatic and Historical orders; all that the former can claim is a constant and increasing predominance. The Dogmatic order cannot, indeed, be followed quite rigorously, for, as we have seen, it implies that the scientific truths have not only been discovered, but systematically recast. Now, such recasting will not, at any given time, embrace the truths most recently discovered. These, therefore, can only be

taught according to the historical arrangement, which will not in such cases be attended with the chief inconveniences that prevent its general adoption.

37. The only fundamental objection which can be urged against the Dogmatic Method is, that it leaves the student in ignorance of the way in which the different Sciences have been built up; a question which, although distinct from the actual acquisition of these Sciences, is in itself of the highest interest for every philosophical mind. This consideration would, in my opinion, have much weight if it was really an argument in favour of the Historical order. But it is evident that learning the truths of a science in their historical order, and learning the actual history of that science, are two quite different studies, as I shall now show.

38. The different subdivisions of each science, which we are led to separate in the Dogmatic order, are in reality developed simultaneously, and under the mutual influence of each other. That is a fact which would naturally tend to make us prefer the Historical order. But when we consider in its entirety the actual development of the human mind, we see further that the different Sciences themselves have, in fact, received improvement simultaneously and from one another. We even see that there is an interdependence between the progress of the Sciences and that of the Arts, owing to their innumerable reciprocal influences, and, finally, that they have all been closely connected with the general development of human society. This vast interlacement is so real that, in order to understand how a scientific theory actually arose, it is often necessary to consider the improvement in some art which has

no rational link with it, or even some particular progress in social organisation without which this discovery could never have taken place. We shall see numerous examples of this as we proceed. It follows from what has been said that we can only know the true history of each science—that is to say, the way in which the discoveries composing it were actually made—by making a direct study of the general history of humanity. That is the reason why all the documents hitherto collected on the history of Mathematics, Astronomy, Medicine, etc., however precious they may be, can only be regarded as materials for the work.

39. The professedly *historical* order of exposition, even if it could be rigorously followed as regards the details of each particular science, would still be purely hypothetical and abstract under the most important aspect, since it would consider the development of the science as an isolated thing. Far from exhibiting the true history of the science, it would lead to a very false conception of it.

40. I am certainly convinced that a knowledge of the history of the Sciences is of the highest importance, and I even think that a science is not completely known if we are ignorant of its history. But this historical study of the Sciences should be looked upon as entirely separate from its proper and dogmatic study, without which, indeed, the history would not be intelligible. I shall, therefore, carefully consider the true history of the fundamental Sciences which are to be the subject of our inquiries; but I shall do so only in the last part of this course—that relating to the study of Social phenomena—in treating of the general development of humanity, of which the history of the Sciences constitutes the

most important, although hitherto the most neglected, part. In the study of each science, such incidental historical considerations as may present themselves will have a clearly distinct character, so as not to affect the main characteristics of our principal study.

41. The preceding discussion in the last thirteen paragraphs, which, as we see, must be specially developed later on, tends to define more precisely the true spirit of this course, by presenting it under a new point of view. But its chief bearing on the question immediately before us is that it determines exactly the conditions which we must impose on ourselves, and which we can justly hope to fulfil, in constructing an encyclopædic scale of the different fundamental Sciences.

42. We see, indeed, that, however perfect we might suppose it to be, this Classification can never absolutely conform to the historical succession of the Sciences. Do what we may, we cannot entirely avoid the necessity of presenting as of earlier date a science which may, however, under some special aspects more or less important, need to borrow from the ideas of another science of subsequent rank. Only we must take care to avoid such derangements with respect to the characteristic conceptions of each science, for in that case the classification would be entirely defective.

43. Thus, for example, it appears to me unquestionable that in the general system of the Sciences, Astronomy should be placed before Physics (properly so-called); and yet several branches of physics, especially optics, are indispensable to the complete exposition of astronomy.

44. Minor defects of this kind, which are strictly inevitable, cannot invalidate



a Classification which in other respects suitably fulfils the principal conditions of the case. They are due to the necessarily artificial element in our division of intellectual work.

45. Nevertheless, although for the reasons already given it would have been improper to take the Historical order for the basis of our Classification, I claim as an essential quality of the encyclopædic scale, which I am going to propose, that it does *broadly* accord with the whole history of science. By this I mean that, in spite of the real and continuous simultaneity of development of the different Sciences, those which will be classed as anterior did, as a matter of fact, start earlier, and always continued to be more advanced than those classed as posterior to them. This is what should inevitably occur if we take—as clearly we ought to—the natural logical connection of the Sciences for our principle of classification; the starting-point of mankind having necessarily been the same as that of the individual.

46. The exact difficulty of this question of the Classification of the Sciences is well illustrated by a very simple mathematical consideration, which will also serve to sum up all the previous arguments in this chapter.

47. The problem before us is the Classification of the Fundamental Sciences. We shall soon see that, all things considered, it is not possible to distinguish less than six of these; most scientists would very likely admit a much larger number. That point settled, we know that six objects permit of 720 distinct classifications, among which we have to choose the one classification which best satisfies the principal conditions of the problem. We see that, in spite of the great number of encyclopædic scales

successively proposed up to the present, the discussion has as yet been confined to a very small number of the possible arrangements. Nevertheless, I believe we can say without any exaggeration that, on examining each of the 720 classifications, there would not perhaps be a single one in favour of which we could not find some plausible arguments. On observing the different arrangements which have been actually proposed, we remark the most extreme differences among them; Sciences which are placed by some at the head of the encyclopædic system being referred by others to the opposite extremity, and vice versa. The real difficulty of the question before us consists, then, in choosing the one truly rational order out of the very considerable number of possible systems.

48. Approaching this great question now in a direct manner, we must, in the first place, remember that, in order to obtain a natural and positive Classification of the Fundamental Sciences, we must seek the principle of it in the comparison of the various orders of phenomena, the discovery of whose laws is the object of those Sciences. What we want to determine is the real dependence of the different scientific studies. Now, this dependence can only result from that of the corresponding phenomena.

49. By considering all observable phenomena under this aspect, we shall presently see that it is possible to class them in a small number of natural categories, so arranged that the rational study of each category may be founded on a knowledge of the principal laws of the preceding one, while serving as the basis of the following one. This order is determined by the degree of simplicity, or, what comes to the same thing, of

generality of the phenomena. Hence results their successive dependence, and, consequently, the greater or less facility in their study.

50. It is clear, indeed *a priori*, that the simplest phenomena—those which are least complicated by others—are necessarily also the most general; for whatever is observed in the greatest number of cases is for that reason disengaged to the utmost degree from the circumstances peculiar to each separate case. We must, therefore, begin with the study of the most general or simple phenomena, proceeding from them successively to the most special or complex. This is necessary if we wish to comprehend Natural Philosophy in a really methodical manner; because this order of generality or simplicity, while it necessarily determines the rational connection of the several fundamental Sciences by the successive dependence of their phenomena, at the same time fixes the degree of facility in their study.

51. There is also a secondary consideration which is, I think, important to notice here, and it leads to exactly the same conclusion as the preceding arguments. The most general or simple phenomena, being of necessity the farthest removed from the human order, must, consequently, admit of being studied in a calmer and more rational frame of mind; that, then, is a further reason why the corresponding Sciences have been developed more rapidly.

52. Having thus indicated the fundamental rule which must preside over the Classification of the Sciences, I can now proceed immediately to the construction of the encyclopædic scale, according to which the plan of this course must be determined, and which each reader will

easily be able to appreciate with the aid of the preceding considerations.

53. The first glance at the aggregate of Natural Phenomena leads us to divide them at starting—in accordance with the principle we have just established—into two great principal classes, the first comprising all the phenomena of Inorganic bodies; the second, all those of Organised bodies.

54. The latter are evidently more complex and less general than the others; they depend upon the Inorganic, which, on the contrary, are in no way dependent upon the Organic. Hence arises the necessity of not studying physiological phenomena until the phenomena of inorganic bodies have been dealt with. In whatever way we may explain the differences between these two kinds of beings, it is certain that we observe in living bodies all the phenomena, whether mechanical or chemical, which occur in inorganic bodies, with the addition of a wholly special order of phenomena, the vital phenomena properly so-called which belong to *organisation*. There is no need to ask if the two classes of bodies are, or are not, of the same *nature*—that is an insoluble question which is still too much debated in our time, owing to the lingering influence of Theological and Metaphysical habits. Such a question does not enter into the domain of the Positive Philosophy, which formally declares its absolute ignorance as to the *ultimate nature* of any body whatsoever. But it is by no means indispensable to look upon inorganic and living bodies as of essentially different nature, in order to recognise the necessity of separating the two studies.

55. No doubt, there is not yet sufficient agreement upon the general mode of regarding the phenomena of living bodies.

But, whatever view may come to be adopted owing to the future progress of Natural Philosophy, the classification which we are establishing will not be in any way affected by that. Indeed, if we could regard as demonstrated, the idea which the present state of Physiology hardly affords any justification for—that physiological phenomena are always simply mechanical, electrical, and chemical phenomena modified by the structure and composition proper to Organised bodies — our fundamental division would none the less hold good. For it still remains true, even in this case, that general phenomena should be studied before proceeding to the examination of the special modifications which they undergo in certain objects of the universe, owing to a peculiar arrangement of their molecules. Most enlightened minds at the present day base this division upon the dissimilarity of the laws concerned; but it is necessarily a permanent one on account of the subordination of the phenomena, and, consequently, of the Sciences dealing with them, whatever affinity the future may establish between these two classes of bodies.

56. This is not the place to develop in detail a general comparison between inorganic and living bodies, because that will be the special subject of a thorough examination in the physiological section of this work. It is sufficient for the present to have recognised in principle the logical necessity of separating the Sciences relating to these classes of phenomena from each other, and of not proceeding to the study of Organic Physics until we have established the general laws of Inorganic Physics.

57. Each of these two great halves of Natural Philosophy can be subdivided

into two branches. We obtain them by a further application of the same general rule.

58. Take, first, Inorganic Physics. Following, as before, the order of the generality and dependence of the phenomena, we see, in the first place, that it must be divided into two distinct sections, according as it deals with phenomena general to the universe or those special to terrestrial bodies. Hence we have Celestial Physics, or Astronomy (whether geometrical or mechanical), and Terrestrial Physics. The necessity for the division is exactly the same as that of the division into Organic and Inorganic.

59. Astronomical phenomena being the most general, simple, and abstract of all, the study of Natural Philosophy must evidently begin with them; for the laws of Astronomy influence those of all other phenomena, but the laws of other phenomena do not influence those of Astronomy. All the phenomena of Terrestrial Physics present the general effect of universal gravitation; they present, in addition, other effects peculiar to themselves and modifying those of gravitation. Hence, if we analyse the simplest terrestrial phenomenon—it need not be a chemical, it may be a purely mechanical one—we always find it to be more complex than the most complicated celestial phenomenon. The most difficult astronomical question, therefore, really presents a less complicated subject for investigation, if all the determining circumstances be taken into account, than the simple movement of a heavy body, even if it be only a solid. Such a consideration shows clearly how indispensable it is to separate distinctly Celestial from Terrestrial Physics, and only to proceed to the

study of the second, after that of the first, which forms its rational basis.

60. Terrestrial Physics is, in its turn, subdivided in the same manner into two very distinct portions, according as we regard bodies from the mechanical or chemical standpoint. Hence we have Physics proper and Chemistry. The latter, if it is to be considered in a truly logical manner, evidently presupposes a previous acquaintance with Physics. For all chemical phenomena are necessarily more complicated than physical ones; they depend on the physical phenomena without influencing them in return. Everyone knows, in fact, that all chemical action is, in the first place, subject to the influence of weight, heat, electricity, etc.; and it presents, in addition, something peculiar to itself which modifies the action of the preceding agents. This consideration, while it exhibits Chemistry as necessarily following after Physics, at the same time presents it as a distinct science. For whatever opinion we may adopt regarding chemical affinity, and even if we should only see in it—as is conceivable—mere modifications of general gravitation produced by the form and mutual arrangement of the atoms, it would still remain unquestionable that the necessity of continually taking these special conditions into account would not allow of our treating Chemistry as a simple appendage to Physics. We should, therefore, in any case, be compelled, if only to facilitate our studies, to maintain that division and order of succession which are regarded now as due to the heterogeneity of the phenomena.

61. Such is, then, the rational distribution of the principal branches of the general Science of Inorganic bodies.

An analogous division arises in the same manner in the general Science of Organised bodies.

62. All living beings present two essentially distinct orders of phenomena—those which relate to the individual, and those which concern the species, especially when it is sociable. It is principally with regard to Man that this distinction is fundamental. The last order of phenomena is evidently more complex and special than the first; it depends on the first without influencing it in return. Hence we have two great sections in Organic Physics—Physiology properly so-called, and Social Physics, which is based upon it.

63. In all Social phenomena we perceive, in the first place, the influence of the physiological laws of the individual, and, in addition, something which modifies their effect arising from the action of the individuals upon each other—singularly complicated in the case of the human race by the action of each generation on its successor. It is, therefore, evident that, in order to study Social phenomena properly, we must start with a good knowledge of the laws relating to the life of the individual. On the other hand, the necessary subordination between the two studies does not oblige us to regard Social Physics as a mere appendage of Physiology, as some eminent physiologists have been led to believe. Although the phenomena are certainly homogeneous, they are not identical, and the separation of the two Sciences is of the highest importance. It would be impossible to treat the collective study of the species as a pure deduction from the study of the individual, since the social conditions which modify the action of the physiological laws are here the most essential

consideration. Social Physics must, therefore, be founded on a set of direct observations peculiar to itself; due regard being always paid to its necessarily intimate relation with Physiology proper.

64. If we wanted our Classification to be perfectly symmetrical, we could easily make a further subdivision of Organic Physics, as we have already made of Inorganic, by availing ourselves of the usual division of Physiology proper into Vegetable and Animal. Such a division would be based on the principle of classification already employed, since the phenomena of animal life are, for the most part, more complex and special than those of vegetable life. But the endeavour to obtain such exact symmetry would be puerile if it involved the ignoring or exaggerating of the real analogies or actual differences between phenomena. Now, it is certain that the distinction between Vegetable and Animal Physiology, while of great importance in what I have called Concrete Physics, has hardly any significance in Abstract Physics, which alone concerns us here. The knowledge of the general laws of life, which we should look upon as the true object of Physiology, requires the simultaneous consideration of the entire organic series without any distinction between plant and animal—a distinction which is, moreover, daily fading away in proportion as those phenomena are studied more profoundly.

65. We shall continue, therefore, to consider that there is only a single division in Organic Physics, although we have thought it necessary to establish two successive ones in Inorganic Physics.

66. It follows from the foregoing discussion that the Positive Philosophy is naturally divided into five Fundamental

Sciences, whose succession is determined by a necessary and invariable subordination, founded merely on a thorough comparison of the corresponding phenomena—quite apart from any hypothetical view on the subject. These Sciences are—Astronomy, Physics, Chemistry, Physiology, and lastly, Social Physics. The first considers the most general, simple, and abstract phenomena—those which are most remote from human interests; they affect all other phenomena, without being in turn influenced by them. The phenomena considered by the last science are, on the contrary, the most special, complicated, and concrete phenomena—those which most directly concern human interests; they depend more or less upon all the preceding phenomena, without—however—exercising any influence upon them. Between these two extremes, the degrees of speciality, of complexity, and individuality of the phenomena go on gradually augmenting in the same proportion as their successive dependence. Such is the most essential general relation between the different fundamental Sciences. We have arrived at it not by drawing arbitrary and empty distinctions, but by a proper use of true philosophic observation. Such must, therefore, be the plan of this course.

67. I have only been able here to set forth in outline the principal considerations on which this Classification rests. To comprehend it thoroughly, it would now be necessary, having viewed it from a general standpoint, to examine it in its special relation to each fundamental science. We shall do that carefully on commencing the special study of each part of this course. The revision of the encyclopædic scale, undertaken in this way at the commencement of each of

the five great Sciences, should make the scale itself more exact and its soundness more evident. The advantages of this plan will be all the clearer because we shall then see the subdivisions of each science falling naturally into order according to the same principle; so that we shall have the whole system of human knowledge analysed, even in its secondary details, in accordance with a rule universally applied—that of the degree of abstraction of the corresponding conceptions. But studies of this kind, besides taking us much too far now, would be certainly out of place in this chapter, where we should maintain our thoughts at the most general standpoint of the Positive Philosophy.

68. Nevertheless, as I shall be constantly employing this fundamental Classification throughout the present treatise, I wish from the outset to make its importance understood. I will, therefore, rapidly review here its most essential general properties.

69. In the first place, a very decisive confirmation of its accuracy is afforded by the circumstance that it is in substantial conformity with the kind of spontaneous arrangement which is, in fact, virtually admitted by scientific specialists.

70. Framers of encyclopædic scales usually take no pains to treat as distinct those Sciences which, in the actual course of intellectual progress and without any premeditated design, have been cultivated separately, and to co-ordinate them in conformity with the real relations exhibited in their daily development. Yet such an accord is evidently the surest index of a good classification; because the divisions which have been spontaneously introduced into the scientific system can only have been

due to a long-experienced feeling of the true needs of the human mind, a feeling which had arisen at a time when there was no erroneous theorising to lead people astray.

71. But although the Classification proposed above fulfils this condition entirely—a fact which it would be superfluous to prove—we must not, therefore, conclude that the habits generally established at the present day among scientists, as the result of experience, would make the work of classification, which I have just performed, unnecessary. They have only rendered such an operation possible, for there is a fundamental difference between an arrangement only reached empirically and the same arrangement conceived rationally. And, besides, this classification is not usually conceived—still less employed—with all the needful precision, nor is its importance properly appreciated; a sufficient proof of that is the serious breaches of this encyclopædic law which are committed every day to the great detriment of the human intellect.

72. A second very essential character of our Classification is that it necessarily conforms to the actual order of development of Natural Philosophy. This fact is verified by all that we know of the history of the Sciences, especially during the last two centuries, where we can follow their progress with much greater accuracy.

73. We see, in fact, that the rational study of each fundamental Science demanded the previous study of all those which preceded it in our encyclopædic scale; it could not, therefore, make any real progress and acquire its true character until there had been a considerable development of the earlier Sciences, dealing with phenomena more

general and more abstract, but less complex, and not dependent on those later than themselves. It is, therefore, in this order that the progress, although simultaneous, was bound to take place.

74. This consideration seems to me so important that I do not think it is possible really to understand the history of the human mind without paying regard to it. The general Law of the Three Stages, which governs the whole of this history, and which was explained in the preceding chapter, cannot be properly understood unless it be applied in combination with the encyclopædic formula just established. For it is according to the order enunciated by this formula that the different human theories have successively attained, first the Theological, then the Metaphysical, and, finally, the Positive state. If, in applying the law, we do not bear in mind this necessary progression, we shall often encounter difficulties which will appear insurmountable. It is clear that the Theological or Metaphysical state of certain fundamental theories was bound to coincide for a time, and, as a matter of fact, has at times coincided, with the Positive state of others which precede them in our encyclopædic system. To verify the fundamental law of Filiation would, therefore, be difficult, did we not at the same time take into account the complementary law of Classification.

75. In the third place, this Classification presents the very remarkable property of indicating in a precise manner the relative perfection of the different Sciences. They approach perfection in proportion as their truths are more precisely known and completely co-ordinated.

76. It is easy to see, indeed, that the

more general, simple, and abstract any phenomena are, the less do they depend on others, and the more precise do the Sciences concerned with them become, while at the same time their co-ordination admits of greater perfection. Thus, Organic phenomena do not permit of such an exact and systematic study as the phenomena of Unorganised bodies. In the same way, in Inorganic Physics, we see that Celestial phenomena, on account of their much greater generality and their independence of all other phenomena, have given rise to a much more precise and closely connected Science than Terrestrial Physics.

77. This fact, which is such a striking one in the actual study of the Sciences, and has often given rise to chimerical hopes or unjust comparisons, is then completely explained by the encyclopædic order now established. I shall naturally have occasion to give it its full extension in the next chapter, when I shall show that the possibility of applying mathematical analysis to the study of different phenomena, and so obtaining for such study the highest possible degree of precision and co-ordination, is in exact proportion to the rank which these phenomena occupy in my encyclopædic scale.

78. I must here put the reader on his guard against a very serious error, which, although gross, is still extremely common. It consists in confounding the degree of precision which the different Sciences admit of with their degree of certitude, whence results the very dangerous assumption that, since the first is obviously very unequal, the second must be so also. Thus people still often speak, although less than formerly, of the unequal certainty of the different Sciences, which tends to

directly discourage the culture of the most difficult ones. It is clear, nevertheless, that precision and certainty are two qualities of very different nature. A wholly absurd proposition may be very precise, as if we should say, for example, that the sum of the angles of a triangle is equal to three right angles; and a very certain proposition may only admit of very imperfect precision, as for instance, when we affirm that every man will die. If, as the preceding explanation shows, the different Sciences must necessarily exhibit a very unequal degree of precision, that is by no means the case as regards their certitude. Each can offer results as certain as those of any other Science, provided that its conclusions are not pushed beyond the degree of precision which the corresponding phenomena admit of, a condition which may not be always very easy to fulfil. In any Science whatever, everything that is simply conjectural is only more or less probable, and it is not that which constitutes its essential domain; everything which is positive—that is to say, founded on well-established facts—is certain, and there is not any distinction between the Sciences in this respect.

79. Finally, the most interesting property of our encyclopædic formula—on account of the importance and multiplicity of the immediate applications which can be made of it—is to determine directly the true general plan of an entirely rational Scientific Education. That follows immediately from the mere composition of the formula.

80. It is, indeed, evident that, before undertaking the methodical study of any of the fundamental Sciences, it is necessary to prepare oneself by the examination of the Sciences preceding

it in our encyclopædic scale. The reason for this is that the earlier Sciences have always a preponderating influence upon the later ones. This consideration is so striking that, notwithstanding its extreme practical importance, I have no need to insist further just now upon a principle which, moreover, will later on inevitably recur in relation to each fundamental Science. I will confine myself to the remark that, if it is eminently applicable to general education, it is particularly so to the special education of scientists.

81. Thus, physicists who have not first studied Astronomy, at least under its general aspect; chemists who, before applying themselves to their special science, have not previously studied Astronomy and then Physics; physiologists who have not prepared themselves for their special labours by a preliminary study of Astronomy, Physics, and Chemistry; all these lack one of the fundamental conditions of their intellectual development. This is still more evident in the case of students who wish to devote themselves to the positive study of Social phenomena, without having in the first place acquired a general knowledge of Astronomy, Physics, Chemistry, and Physiology.

82. As these conditions are very rarely fulfilled at present, and as no regular institution has been organised to carry them out, we must acknowledge that no truly rational education yet exists for scientists. This consideration is, in my opinion, of such great importance that I do not hesitate to attribute in part to this defect in our present educational system the state of extreme imperfection which we still witness in the more difficult Sciences—an inferiority really so excessive that it cannot be entirely



accounted for by the greater complexity of the phenomena.

83. As regards general education, this condition is still more necessary. I regard it as so indispensable that I believe instruction in the Sciences will fail to bring about its most essential general purpose—the intellectual and social ascendancy of the scientific spirit—unless those Sciences are studied in their proper order. We must not forget that in almost all minds, even the highest, ideas usually remain associated together according to the order in which they were first acquired; and it is, consequently, in most cases an irremediable evil not to have commenced at the beginning. The number of persons in any century who, after arriving at manhood, are able, like Bacon, Descartes, and Leibnitz, to make a clean sweep of their acquired ideas and reconstruct them systematically from the foundation, is small indeed.

84. The importance of our encyclopædic law as a basis for Scientific Education can only be properly appreciated by considering it also in relation to Method, instead of only regarding it, as we have hitherto done, from the standpoint of Doctrine.

85. Under this new aspect, the carrying out of the general plan of education which we have laid down must have as its necessary result the acquisition of a perfect knowledge of the Positive Method, which could not be obtained in any other manner.

86. For Natural Phenomena have been classed in such a way that those which are really homogeneous always remain comprised within the same Science, while those which belong to different Sciences are really heterogeneous. The consequence is that the

general Positive Method will be constantly modified in an uniform manner throughout the extent of each fundamental Science; and it will be continually undergoing different modifications of increasing complexity, in passing from one Science to another. In this way we shall be certain of having considered all the real modifications which it admits of. We should have no such certainty if we adopted an encyclopædic formula which did not fulfil the essential conditions laid down above.

87. This new consideration is of truly fundamental importance. As we saw, in a general way, in the last chapter, it is impossible to understand the Positive Method apart from its application, and we must now add that we can only form a clear and exact idea of it by studying successively in due order its application to all the different principal classes of Natural Phenomena. No one Science, however well chosen, would be sufficient for the attainment of this object. Of course, the Method is essentially the same in all. But it has various forms of procedure, each of which is specially developed in some one Science, and being less developed in the others would in them escape notice. Thus, for instance, the principal means of exploration in some Sciences is Observation properly so-called; in others it is Experiment, and a particular kind of Experiment. Similarly we notice that this or that general precept, forming an integral part of the Scientific Method, has been originally suggested by some particular Science; and, although it may have been subsequently applied in others, it is at its original source that we must study it, if we would know it thoroughly. The Theory of Classification, for instance, is best studied in Biology.

88. If we limited ourselves to the study of a single Science, we should, no doubt, choose the most perfect one in order to obtain the best idea of the Positive Method. But, as the most perfect is at the same time the simplest, we should in this way only obtain a very incomplete knowledge of the Method, since we should not learn what essential modifications it must undergo in order to adapt it to more complex phenomena. Each fundamental Science has, therefore, in this respect some advantages which are peculiar to it. This clearly shows the necessity of paying regard to all of them, lest we should form too narrow conceptions and inadequate mental habits. As this consideration will frequently recur in the course of the work, it is unnecessary to develop it further at this stage.

89. I must, nevertheless, insist here specially, with a view to a sound knowledge of the Method, on the need of not only studying all the fundamental Sciences in a philosophical manner, but of studying them according to the encyclopædic order established in this chapter. How can a mind, unless of the highest natural superiority, produce anything of value if it begins by studying the most complex phenomena, without having previously learnt to know by examining simpler phenomena—what a Law is, what it is to Observe, what a Positive Conception is, and even what a Connected Argument is? Such is, however, still at the present day the ordinary procedure with our young physiologists, who plunge immediately into the study of living bodies, without, as a rule, any other preparation than the study of one or two dead languages, with at most only a very superficial knowledge of Physics and Chemistry. The latter knowledge

is almost valueless from the standpoint of Method, since it has not been usually obtained in a rational manner, or by starting from the true point of departure in Natural Philosophy. We can see how important it is to reform such a defective course of study. In the same way, with regard to Social phenomena, which are still more complicated, would it not be taking an important step towards the return of modern society to a truly normal state, if we recognised the logical necessity of not proceeding to the study of these phenomena until the mind of the student has been gradually trained by a philosophical examination of all the preceding phenomena? It would be quite true to say that this constitutes the principal difficulty, for there are few able minds at the present day which are not convinced that we must study Social phenomena according to the Positive Method. But those who are engaged in this study do not, and cannot, know exactly in what this Method consists, because they have not examined it in its earlier applications. This maxim has, therefore, up to the present remained barren as regards the renovation of Social theories, which have not yet emerged from the Theological or Metaphysical state, in spite of the efforts of so-called positive reformers. Later on, this consideration will be treated in full; at present I must confine myself to pointing it out, so as to show the whole scope of the encyclopædic conception which has been propounded in this chapter.

90. Such are, then, the four principal aspects under which I have thought it necessary to exhibit the general importance of the rational and positive Classification of the Fundamental Sciences.

91. In order to complete the general explanation of the plan of this course,

I have now to consider an immense and all-important gap which has been intentionally left in my encyclopædic formula ; it is an omission which the reader has, no doubt, already noticed. I refer to the fact that we have not yet found a place for Mathematics in our scientific system.

92. It is just because of its importance that I have not yet mentioned this great and fundamental Science. The next chapter will be entirely devoted to the exact determination of its true general character, and, consequently, of its encyclopædic rank. But, in order not to leave such a serious blank in the great plan which I have tried to sketch out in this chapter, a summary account must be given here of the general results of the examination which we shall undertake in the following chapter.

93. In the present state of development of our positive knowledge we must, I think, look upon Mathematics, not so much as a constituent part of Natural Philosophy properly so-called, but as having been since Descartes and Newton the true fundamental basis of the whole of that philosophy ; although it is, strictly speaking, both one and the other. At the present time, indeed, Mathematical Science is of much less importance for the knowledge of which it consists—real and valuable as that knowledge is—than as constituting the most powerful instrument which the human mind can employ in investigating the laws of Natural Phenomena.

94. To form in this respect a perfectly clear and rigorously exact conception of Mathematics, we see that it must be divided into two great sciences whose character is essentially distinct : Abstract Mathematics or the Calculus—using that word in its widest sense—and Concrete

Mathematics, which is composed of General Geometry and of Rational Mechanics. The Concrete part is necessarily founded on the Abstract part, and it becomes in its turn the direct basis of all Natural Philosophy ; all the phenomena of the universe being regarded, as far as possible, as either Geometrical or Mechanical.

95. The Abstract part is the only portion which is purely instrumental, being simply an immense and admirable extension of natural logic to a certain order of deductions. Geometry and Mechanics must, on the contrary, be regarded as true Natural Sciences, founded like all others on observation ; although, on account of the extreme simplicity of their phenomena, they admit of an infinitely more perfect degree of systematisation, which has sometimes led to the experimental character of their first principles being too much lost sight of. But these two principal sciences possess this peculiarity—that in the present state of the human mind they are already, and will be more and more, employed as Method rather than as direct Doctrine.

96. It is besides evident that, in thus placing Mathematical Science at the head of Positive Philosophy, we are only making a further application of the same principle of classification which has furnished us with the encyclopædic series established in this chapter—a principle founded on the successive dependence of the Sciences, which results from the more or less abstract character of the phenomena they deal with. We are now only restoring to this series its true first term, the peculiar importance of which demanded a special and fuller examination. We see, in fact, that Geometrical and Mechanical

phenomena are the most general, simple, abstract, and irreducible of all, and that they do not depend on the others, but, on the contrary, are their basis. We also see that their study is an indispensable preliminary to that of all the other orders of phenomena. It is, therefore, Mathematical Science which must constitute the true starting-point of all rational scientific education, whether general or special. This explains the universal custom which has been for a long while established on this subject in an empirical manner, although it had originally no other origin than the greater relative antiquity of Mathematics. I must confine myself for the present to this very rapid sketch of these different considerations; they will form the special subject of the following chapter.

97. In this chapter, then, we have exactly determined the rational plan which should constantly guide us in the study of Positive Philosophy, not deducing it from vague arbitrary speculations, but regarding the question as the subject of a true philosophical problem. As the final result we have—Mathematics, Astronomy, Physics, Chemistry, Physiology, and Social Physics. That is the encyclopædic formula which, among the numerous possible classifications of the six Fundamental Sciences, is the only one con-

forming logically to the natural and invariable order of phenomena. I need not dwell on the importance of this result. The reader must make himself quite familiar with it, for he will have to be constantly applying it throughout this course.

98. The final result of this chapter, to put it most simply, has been to explain and justify the great Synoptical Table placed at the beginning of the present work, in constructing which I have striven to arrange the subdivisions of each Fundamental Science in as clear conformity as possible with the same principle of Classification which has given us the general series of the Sciences.

#### NOTE BY THE TRANSLATOR.

(1) The word "Physiology" in this translation must be considered as invariably equivalent to the term "Biology"; and the latter word was actually employed by Comte in Vol. III. of the *Philosophie Positive* (1838).

(2) In 1839, in Vol. IV. of the *Philosophie Positive*, we find Comte using, for the first time, the word "Sociology" in preference to the expression "Social Physics." It is, therefore, to Comte that we are indebted for the now universally-adopted name of "Sociology."

(3) The reader will notice that in the Synoptical Table only six fundamental sciences are given; the crowning science of Morals or Ethics was not separated from Sociology by Comte until the publication of Vol. II. of the *Politique Positive* in 1852.













